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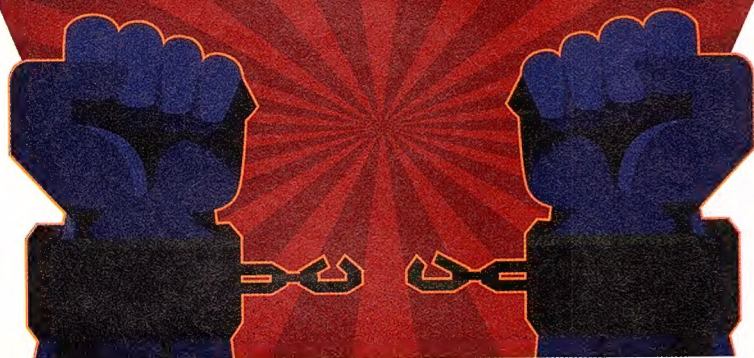
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editorial

DAN GARDINER

Even at 20, the web's still revolutionary

FREEDOM



The World Wide Web recently hit the ripe of age of 20 – an eon in tech – having been officially switched on in April 1993. In that time it, and the tech industry in general, have both seen staggering amounts of change. And while the recent revelations about PRISM and other online spying operations might have convinced you that the web is merely a great tool for Big Brother to keep tabs on us all, it's important to remember that it's still a great platform for disruption, too.

At a glance, the web may look like it's been gentrified and thoroughly dominated by big companies such as Google and Facebook, but dig a little deeper and you'll find that many of today's cutting-edge sites, services and apps still come from small dedicated outfits. Dropbox is hard to beat when it comes to cloud storage, for example, and these days I've largely ditched traditional office suites to do most of my writing and planning in online notetaking/database app Evernote. I get most of my news via RSS reader Feedly (feedly.com) and flick anything longer over to Pocket (getpocket.com) to read on my smartphone or tablet. To me, that amply proves there's still plenty of room to compete with the big guys if you can create or capture yourself a niche.

It's not just software and services that are healthy either. There's a mini hardware revolution going on right now, too, with devices like Arduino and Raspberry Pi making home hacking and electronics cool again – and affordable to even the least well-off tech enthusiasts. The ARM chips at the core of these devices have also become so cheap that it's now possible to shove a processor in basically anything – something we're just starting to see the ramifications of in the impending tsunami of wearable electronics.

Kickstarter and crowdfunding are also changing the way people do business, allowing creators to go directly to their customers to ask for the money to finance even grand ideas, all without needing to jump through the hoops of seeking venture capital, bank loans or selling your idea to a bigger company. Crowdfunding is admittedly best suited to product-centric businesses at this early stage, though it'll undoubtedly become more widespread.

Entertainment is being shaken up, too, with online-only TV shows starting to appear, and the video gaming industry being given a good kick up the bum by the rise of indie games. These are often willing to take the risks the big guys aren't and can therefore provide some of the most inventive and enthralling experiences available.

In fact, whether it's business, politics, entertainment, education or any other area you look at, tech is still fuelling revolutions, both big and little, in just about every important area. And despite the fact that technology is ripe for abuse in the wrong hands, it's something that ultimately gives me great hope for the future.

In short, despite the occasional setback, the web-fuelled revolution is still ongoing. It most assuredly will be televised – and streamed, tweeted, pinned, Instagrammed, blogged about, printed out in 3D, reverse-engineered, cloned in a Chinese factory and finally (though it may take a while), it'll eventually make itself felt by everyone. It's still a great time to be a geek.

Dan Gardiner

apc

EDITORIAL

Editor DAN GARDINER dmgardiner@bauer-media.com.au
 Managing Editor MELANIE PIKE mjpike@bauer-media.com.au
 Technical Writer DOMINIK KRUPINKSI dkrupinski@bauer-media.com.au
 Features Editor PETER DOCKRILL pdockrill@bauer-media.com.au
 Contributors JOHN ALLSOPP; DANIEL CHENG; SIMON CHESTER; RICHARD COBBETT; TROY COLEMAN; LINDSAY HANDMER; DAVE JAMES; CASSANDRA KHAW; ALEX KIDMAN; JEREMY LAIRD; ASHTON MILLS; MATTHEW J.C. POWELL; NATHAN TAYLOR; DARREN YATES

DESIGN

Art Director DAVID COLLINS
 Senior Designer SALLY RYAN
 Photography GETTY IMAGES

PRODUCTION

Chief Sub-Editor OLGA JEVDIC ojevdic@bauer-media.com.au
 Junior Sub-Editor GOLDIE HONG ghong@bauer-media.com.au
 Production Controller DOMINIQUE ROY

MULTIMEDIA

DVD Editor PETER DOCKRILL

ADVERTISING

National Sales Manager AARON MORTON
AMorton@bauer-media.com.au (02) 9263 9744
 Advertising co-ordinator JEMMA NICHOLSON
jnicholson@acpmagazines.com.au (02) 9288 9149

MARKETING

Marketing Brand Manager KIMBERLY OMODEI

CONTACTING US

Email apcmag@bauer-media.com.au
 Web www.apcmag.com
 Phone (02) 9288 9105 Fax (02) 9267 4909
 Postal PO Box 4088, Sydney NSW 2001
 Street Level 18, 66 Goulburn Street, Sydney 2000
 For opinions you must include your full name, address and B/H contact telephone number, otherwise it cannot be considered for publication.
apcmag@bauer-media.com.au

REPRINTS AND COPYRIGHT

Contact HELEN CHEN hchen@bauer-media.com.au

SYNDICATION ENQUIRIES

London JOHN SLATER Phone 44 20 7812 6527 Email jslater@acpuk.com
 Sydney GREG ALLEN-WATERS Phone 612 9282 8808
 Email gallen-waters@bauer-media.com.au

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IT PRICING

GREAT SOUTHERN TECH TAX

The government's report on IT pricing is finally out. Is anyone surprised by the results?

Well, it's probably about as official as it's ever gonna get – the Australian government has finally confirmed that we're getting ripped off when it comes to buying tech. From information compiled by a government committee over a 12-month period (from mid-2012 to mid-2013), the new report, titled *At what cost? IT pricing and the Australia tax*, essentially confirms what we've all known for years: we often pay significantly more than our US and European counterparts when it comes to tech products. Overall, it surmised that "in many cases, the price differences for IT products cannot be explained by the cost of doing business in Australia".

The report acknowledges that Australia has paid higher prices for IT gear for many years, but that the prevalence of widespread internet access and Australia's fervour for online shopping (where our average annual spend is second only to the UK) has made price disparities far more obvious and easier for individuals and businesses to check.

THE BIGGEST OFFENDERS

Topping the list of price disparities were games (84% more expensive in Australia, on average), music (52%), professional software (49%) and tech hardware (46%). Adobe and Microsoft were singled out in the professional software category, with average software prices that were higher by 42% and 66%, respectively, than in comparative territories including the US and UK. (In Adobe's defence, the company has since announced that its professional-level software will become subscription-only in future, available exclusively through its Creative Cloud service. Pricing in Australia is the same as the US – both are \$49.99 per month on a 12-month contract.) The committee also found differences in ebook pricing, but were less pronounced at around 16% on average.

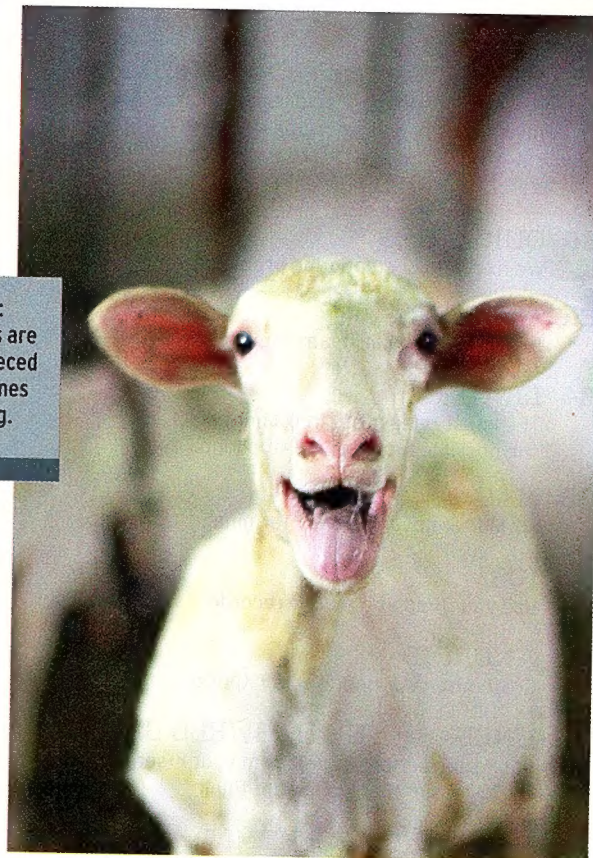
Not all categories and vendors came out looking bad, however. Apple's pricing, for example, was largely deemed fair when the GST was taken into account: "The prices for Apple products were much closer to parity – the majority of Apple's iPad, iMac and MacBook lines were generally 10 to 15% more expensive in Australia." Prices of individual songs in Apple's iTunes music store weren't quite so reasonable, though, with tracks often marked up from US\$1.29 to \$2.19 – or 67%. The cost of buying a whole album from iTunes was, on average, 51% higher in Australia than in the US.

Even technology products to assist the disabled, such as braille readers, were subject to price increases in Australia, where they saw mark-ups of between 4% to 30%.

WHAT CAN BE DONE?

The report presents some real, concrete strategies that can be used to fight back. Primary among those was the directive that existing copyright laws should be clarified so as to clearly state that Australian consumers have the right to circumvent "measures that control geographic market segmentation" or geoblocks. The report states it

It's official:
Australians are
getting fleeced
when it comes
to IT pricing.



should only be used "as an option of last resort" and suggested that Australian consumers should be educated about what their rights are with regard to overcoming geoblocks, as well as any potential risks (with warranties, for example) that this may entail.

Digital rights management of digital-delivered products was also targeted. The report stated that a "right of resale" should be established to allow consumers and businesses to resell digital content like music, movies, books and games. It's an issue that's recently come up in European courts; German advocacy group Verbraucherzentrale Bundesverband plans to take game developer Valve to court over the lack of a resale option for games purchased on Steam. There is also precedent for success: last year, software company Oracle lost a case in Germany in which it sought to prevent a third-party, UsedSoft GmbH, from reselling software licences for some of its programs.

The report also recommended that such a resale right should include clarification of Australian fair use rights and seek to impose "restrictions on vendors' ability to 'lock' digital content into a particular ecosystem."

WHAT IT MEANS

For now, these are just recommendations. However, they make it pretty clear what the government's position is – not only are these issues unfair on the consumer, but from a business and education standpoint they can reduce Australia's ability to remain competitive at an international level. And that lack of equality is, we reckon, downright un-Australian.

WHAT'S IN A NAME?

SkyDrive gets shot down

If the disaster of Windows RT wasn't enough, the Redmond software giant also suffered a blow in the UK courts recently, which ruled in favour of British Sky Broadcasting Group (BSkyB) in a dispute over Microsoft's use of the SkyDrive name. The two companies have reached a confidential settlement, with Microsoft agreeing to a worldwide rebrand of its cloud storage service, though the latter will be able to continue using the SkyDrive name "for a reasonable period of time" while it rebrands. Though Windows and Office are still household names, Microsoft has had less luck establishing its newer web products and services. SkyDrive was arguably one of the more successful ones. This isn't the first rebranding debacle that Microsoft has seen in recent history, either – it was forced to rename Windows 8's Metro UI to Modern UI after a German company filed suit last year. Let's hope that SkyDrive at least gets named something a little more distinctive and memorable...

something
SkyDrive

What would you like to see SkyDrive be renamed to? Send your suggestions to apcmag@bauer-media.com.au

Demand for Microsoft's Surface RT tablet has been tepid.



WINDOWS

IS WINDOWS RT ON THE ROPES?

Things are not looking hopeful for the newest stablemate in the Windows family.

Despite a slickly choreographed advertising campaign, battery life to match the iPad and the option of a dedicated keyboard, Microsoft's Surface RT tablet has clearly failed to meet expectations, with the Washington company's most recent quarterly report revealing that it's been left holding US\$900 million worth of unsold stock. To put things in perspective, the company has sold just US\$863 million worth of Surface products – encompassing both the RT and Pro versions of the tablet – since the line launched in October last year.

More broadly speaking, things aren't looking great for the Windows RT line of products as a whole. Even Microsoft's early launch partners, such as ASUS, seem to have bailed on RT – only Nokia and Microsoft itself have RT-based tablets in development, if rumours are to be believed. On the other hand, the list of vendors who've considered and abandoned RT products now holds some very big names – Samsung, HTC, Toshiba, Acer and HP are among them.

Microsoft has often been accused of doing a poor job of explaining the difference between Windows 8 and RT. The latter is a cut-down version of the Windows 8 OS that comes with Office preinstalled, but is limited to running applications purchased and installed from the Windows Store app, which works much like Apple's App Store on iOS or Google's Play Store on Android. That, combined with a perhaps optimistic asking price, would seem to have dampened the RT's appeal right from the start.

Can Microsoft do anything to save RT? Perhaps. Backwards compatibility with older applications is still Windows' strongest weapon against its newer tablet competitors, and hackers have proved that RT devices can easily be 'jailbroken' to run applications not purchased via the Windows Store.

Even 10 months in, Windows tablets suffer from a lack of dedicated, compelling touchscreen apps and while there's not a lot Microsoft can do to turn that around quickly, it could unlock RT so that traditional Windows apps could more easily be ported to the platform. (The different ARM hardware used by RT tablets would mean software would have to be recompiled to work on them, but that's significantly easier than writing new apps from scratch.)

Perhaps we shouldn't be so hasty to write off Windows RT so soon – after all, this is a first-generation product. But if Microsoft can't come up with a way to radically increase RT's appeal soon, it could prove to be the shortest-lived version of Windows yet.

300GB

50

Rumoured model number of anticipated 'budget' iPhone slated to hit next month

With the next iPhone reveal tipped for mid-September, Applemania is kicking off for another year with the expected flurry of leaks and fakes. Widely circulated images of what looks like product packaging for the upcoming 'cheap' iPhone suggest it will be called the iPhone 5C, which allegedly stands for 'Colour'. Colour us curious – and only a little bit doubtful...

Proposed storage volume of a new optical disc format being worked on by Sony and Panasonic

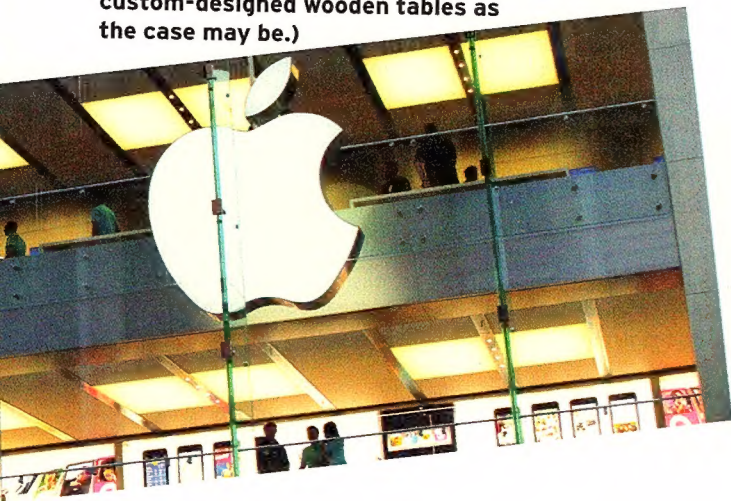


Just when you thought it was all over for optical media, out comes news of a new disc standard being devised under a recent partnership struck between Sony and Panasonic. Aimed at professional users who need heavy-duty archiving capability, the next-generation standard is set to see the light of day by the end of 2015 and may later get the green light for the consumer market. But what will they call it... Blu-ray HD? Mega Super HD-DVD?

\$5,971

Amount made in sales per square foot in Apple Stores last year (US dollars)

It's no secret Apple pulls in uber revenue in its retail stores, but with iPhone penetration hitting near saturation point in many developed markets, sales seem to be slowing down. According to a report in *The Wall Street Journal*, Apple Stores' per-square-foot sales are down some 4.5% from this time last year. That's still a heck of a lot of iDevices flying off the racks (or tasteful custom-designed wooden tables as the case may be.)



2,000+



Number of customisable combinations of Motorola's upcoming Moto X smartphone

Black, white and silver are the standard colour choices for most phones on the market today (OK, maybe not Windows Phones). But what if you want a little more say in the look and feel of your device? Motorola's new Moto X – the first Moto phone designed under owner Google's watchful eye – lets you dictate the front, back, accents, memory, wallpapers and inscription on your Android device. There's even a wood backplate option. And it's all 100% lovingly crafted in the US of A! (An apparent smartphone first, but admittedly not such a big selling point for Australian users.)

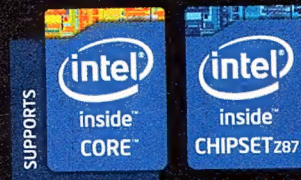


\$35

Cost in US dollars of Google's new Chromecast HDMI dongle

The battle for the living room just got serious. Google's Chromecast is a super-cheap way to get web content onto the biggest screen in your house, effectively turning any 'dumb' TV into a 'smart' one. Set to compete with products like Apple TV and Roku, Chromecast mirrors cloud content on your telly (first streamed to a Chrome browser device on your network) and lets you use your phone, tablet or PC as a remote. Check out our mini-review in Gadgets (page 11). [ATC](#)

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BY GOLDIE HONG

Sony SmartWatch 2

Smartwatches are a huge market right now. The Kickstartered (is that a word?) Pebble has just seen wide retail release in the US, while Apple's iWatch and Samsung's Galaxy GEAR SmartWatch are both currently in the works. Sony's hoping to crash that competition's party with its brand-new SmartWatch 2, which is set for a US September 9 release. Like its predecessor, the SmartWatch 2 is Android-compatible, working with all smartphones using Android 4.0 or later, and interacts with your smartphone over Bluetooth. It now features one-touch NFC connectivity, a higher-res screen, longer battery life and is water-resistant. It's all tucked nicely in a 122.5g aluminium body that comes with a stainless steel wristband. With the ability to conveniently access your notifications such as messages, calls, email, calendar, music, plus Facebook and Twitter updates from your wrist, you should never miss a beat ever again.

ONLINE www.sonymobile.com



\$TBA



US \$390
limited
pre-order
price

Smiirl Fliike

Get a lot of likes on Facebook? But more importantly, are you keen to show off all your likes? Now you can with the Fliike – a physical 'fan counter' that connects to your Facebook account via Wi-Fi and syncs all the likes your page gets in real time. Douche? Perhaps. But given that it was designed primarily for local businesses in mind for use in public places – to be hung up on a wall or placed on a counter or desk, for example – it could actually be a great marketing tool. Smiirl, the French startup behind the 16.5 x 4.72-inch Fliike, is currently accepting a limited number of 500 pre-orders at the lower promotional cost of US\$390 (no word yet on the full RRP). Better get in quick if you think you might 'like' the Fliike, then! (Sorry.)

ONLINE www.smiirl.com

Panasonic SC-NT10

What makes the SC-NT10 wireless Bluetooth speaker really cool is that it's geared for heavy outdoor use to withstand the rough 'n' tough of any pool parties or camping trips you partake in – no matter how crazy things get. Panasonic claims the 'quad proof' speaker can endure dust, shock (it passed drop tests from a maximum of 30 inches), freezing and blazing temperatures, and is also splash-proof – perfect for the aforementioned pool party. Other cool features include its NFC capabilities (all you have to do is touch your phone to the speaker and it works its magic), a 3.5mm jack, the ability to amplify low-frequency sounds, eliminate distortion and a battery life of up to eight hours. We think this rugged gadget could definitely survive a day with Bear Grylls. And that guy drank his own pee.

ONLINE www.panasonic.com.au



US \$100
pre-order

Motorola Moto X

It seems Motorola's pulling out all the stops with its shiny new flagship phone – the Moto X – and for valid reason. Motorola is standing pretty far behind Samsung and HTC in terms of Android smartphone market share and it's hoping the Moto X will boost its appeal to the masses. Featuring a customisable Kevlar backplate and a 4.5-inch 720p display, the front-facing 2.1MP camera lets you do HD-quality video conferencing, while a 10.5MP rear camera should snap decent still pics, too. So will the Moto X pose a threat to the stronghold that the hugely popular Galaxy S4 and HTC One have on the Android market? Definitely watch this space, as we'll no doubt provide a more in-depth review and comparisons soon.

ONLINE www.motorola.com.au

\$TBA



US\$35

Google Chromecast

Google's latest attempt at invading our living rooms comes in the form of the thumb-sized Chromecast, a multimedia dongle that plugs into an HDTV's HDMI port, effectively turning it into a second screen for any Google-powered devices (namely, Android tablets and smartphones, PCs/Macs using the Chrome browser and even iOS 6.0+ iPhones, iPads and iPods). This means you can easily enjoy your favourite movies, TV shows, music and more on your HDTV. Currently, the list of offerings covers only a few major sites such as big players YouTube, Netflix and Pandora, but we're sure this list will expand as the Chromecast grows in popularity (it sold out in less than two hours at launch). There's no set date for an Australian release at the time of writing and just one day after launch, Google had ended the three months of Netflix for free promo, due to overwhelming demand.

ONLINE www.google.com

US \$400

Panasonic Lumix DMC-FZ70

Panasonic's latest compact camera from its FZ series features a whopping 60x optical zoom – claimed to be the largest zoom range of any consumer compact cam on the market right now. It's therefore ideal for users who plan to snap shots at a distance. The Lumix DMC-FZ70's 'Intelligent Zoom' function further enables the optical zoom to be enhanced to 120x, along with a 16.1MP sensor and an equivalent focal length of 20-1200mm. To sweeten the deal even more, Panasonic reckons its newest addition starts up in just 0.9 seconds and supports continuous shooting at 9fps (full resolution with limited AF). It's also the first camera in the range boasting Panasonic's new Windshield Zoom Microphone, which apparently cuts down wind noise by around 70%.

ONLINE www.panasonic.com.au



CHANGING THE GAME

APC delves inside the Xbox One and PS4 to discover what these AMD-powered consoles mean for the future of the PC.

Sony and Microsoft have finally shown their hands. The Xbox One and PlayStation 4, the latest WMDs in the unceasing console war, have been revealed and as ever, both companies displayed a startling disconnect from the mind of the average gamer: Microsoft appeared absolutely committed on fulfilling a dare to say the word 'TV' at least once a second at its pre-E3 reveal, while Sony was so caught up in highlighting and opposing the enemy's absurd DRM policy and pricing at gaming's biggest expo that it almost forgot to show any games. Oh, and then Microsoft pulled a shameless, squealing-tyres about-turn and retracted its 24-hour internet connection requirement and used games policy.

But between the bouts of smack talk, two impressive portals to next-gen gaming nonetheless emerged. Both consoles aim for

1080p gaming at 60 frames per second, a privilege once reserved for high-end PC owners only, and both have the hardware underneath their remarkably similar chassis to make that promise a distinct reality. Both DICE and 343 Industries were proud to confirm that *Battlefield 4* and *Halo* for Xbox One, respectively, will run at 1080p. On the PS4, *Killzone: Shadow Fall* looks like something your \$1,800 desktop PC dreams about when it goes into standby, boasting huge draw distances and extraordinary particle effects.

If it feels like Xbox One and PS4 are finally treading on the PC gamer's territory, it's because they are. What was once a ravine in performance terms between home consoles and your average gaming PC is now much narrower, especially considering both machines retail for under \$600. But how much do we really need to arch our backs and hiss at PS4

and Xbox One's confident strut towards super high-fidelity gaming? The answer lies not just with the silicon at the beating heart of each console, but with ever-improving PC architecture like Intel's new Haswell processors, and the rise of home theatre PCs like Intel's NUC, powered by the 'system-on-a-chip' Haswell architecture.

The NUC is around one-quarter the size of each next-gen console and while it doesn't trouble top-tier desktop systems for performance, its hugely improved on-die graphics core makes it a capable DirectX 11 machine and a strong signal of mobility-focused intent from the biggest player on the PC market. So, we've seen the hardware from all three camps and we know the numbers. There remains only one thing to do: mash those numbers up against each other until an indisputable conclusion is reached...





The Xbox One from Microsoft, the Sony PlayStation 4, Intel's NUC and the Nintendo Wii U are about to close the gap that's separated consoles from PCs.





Can a game like *Killzone: Shadow Fall* help the PS4 rival a PC?

Hardcore console fanboys can (and often will) spend until the end of time copying and pasting spec sheets on message boards that they believe somehow proves the superiority of one machine over the other.

Meanwhile, hardcore PC enthusiasts happily build \$3,000+ systems for the three games each year that'll be able to utilise the bleeding-edge tech inside, confident of their platform's superiority because just look at that *Counter-Strike: Global Offensive* frame rate! We're not trying to hit you with the existence-is-futile stick or anything here – it's just important to establish that if you're so inclined, you can use the numbers associated with any platform to demonstrate its supremacy.

To ascertain how the PC really looks in the dawn light of the next generation, we're going to need to delve deeper into a few vital areas. How do game developers feel about working on games for each platform? How are they all going to mature in the coming years? And has anyone bought a Wii U yet?

UNDER THE BONNETS

Before we poke at this new hardware like inquisitive children examining roadkill, a couple of points. Firstly, we'll get nowhere comparing ultra-high-end PCs with four-way SLI setups and liquid-cooled, overclocked CPUs to next-gen consoles. Yes, they're still more powerful and you're special for having one, and consoles are but a child's plaything by comparison. Seriously, you'll always be able to build a system that's ahead of the curve if you have enough money. However, not everyone has so much spare cash these days.

Secondly, we're not treating the Wii U as a serious contender in this face-off, on the grounds that it barely manages to outperform the Wii and its exclusive titles are becoming thin on the ground. That the Wii outsold the Wii U by 20,000 units in the US in April only further demonstrates that Nintendo's new hardware is less next-gen and more a post-it note slapped on the current one.

One thing all the manufacturers involved can agree on in an otherwise radically varied approach to next-gen is in moving as much of the system's workload onto one die as possible. Both the PS4 and Xbox One feature APUs based around AMD's Jaguar eight-core architecture, and PS4's lead architect Mark Cerny has gone as far as saying that not just the graphics and CPU are on one chip, but a "large number of other units" too. It's certainly no surprise that both Sony and Microsoft have a similar APU – they're both supplied by AMD.

It's also bang on trend with the bigger picture in CPU/APU architecture: mobility. Mobile tech has been the biggest growth sector in tech for the duration of PS3 and Xbox 360's lifespan, and both AMD

and Intel have increasingly prioritised the ever-decreasing form factor, along with ever-increasing power efficiency to prolong battery life, rather than outright performance. When the current console generation began in 2006, we didn't even have the ASUS Eee PC netbooks yet. If someone had shown you a prototype of the iPad in that simpler time, you'd say: "That's silly. Stop being silly." Seven years of frenzied development and

PS4

An impressive spec sheet for Sony, particularly in the silicon category. The PS4's custom Radeon HD 7850 equivalent won't be troubling top-end gaming PCs for raw performance, but combined with 8GB of GDDR5 memory, it has notably more grunt – on paper – than Microsoft's machine. An internet connection isn't required, but Sony moved towards the Xbox Live model by charging a subscription fee to play games online. That's a touch of bad news the Japanese giant must have felt more comfortable about delivering after Xbox One's gamer-ambivalent presentation. At \$549, it loses out to the Wii U in pricing, but Nintendo's maligned quasi-next-gen machine has little else to offer.

PS4 INFO

Manufacturer: Sony
Release date: Christmas 2013
Price: \$549
Media: Blu-ray drive
CPU: Proprietary eight-core AMD x86-64
GPU: Radeon HD 7850 equivalent
Memory: 8GB GDDR5
Storage: 500GB HDD
Ports: USB 3.0 x 2
Required internet connection: No
Backwards compatibility: No



Xbox One

Microsoft's next-generation hope is the most expensive games console of all time at \$599 and if there's a reason for the high pricing, it's not exactly evident in its specs. Architecturally, it appears similar to PS4's eight-core APU design, but loses out by opting for plain old 2,133MHz DDR3 memory over Sony's much higher-bandwidth GDDR5. It also features a reportedly weaker GPU. Still, nothing a hastily sweetened DRM policy and a new and improved version of your old friend Kinect can't fix, though, right? At least the inclusion of a much-needed Blu-ray drive will see an end to the days of multi-disc box copies.

explosive growth later, it's mobile tech powering consoles designed specifically to sit undisturbed under your TV.

So who wins the battle of APU? It's less of a dead heat than it might seem. While Microsoft's using 8GB of memory over an interface shared by graphics and processing (just like Sony), the Xbox One's memory is DDR3 operating at 2,133MHz, while the PS4 uses GDDR5 memory – the kind your graphics card uses. GDDR's primary advantage is higher bandwidth and according to Cerny, the PS4 is capable of 176GB/s. Microsoft's lower-latency DDR3, with the 32MB ESRAM attached, should be capable of around 133GB/s in general use, despite a touted 'theoretical peak' of around 192GB/s.

That leaves the humble PC in a bittersweet place by comparison. On the one hand, Intel's latest architecture pretty much has 'we don't care about PC gamers!' printed on each chip, such is the minute performance increase it holds over Ivy Bridge in a gaming context. Mobility, battery performance, integration: this has been the direction both AMD and Intel have been taking for almost a decade now, so what's going to change it?

Well, we are. If you've ever overclocked a CPU, please administer a self-congratulatory shoulder pat because it's that nerve-rendering BIOS

Manufacturer: Microsoft
Release date: November 2013
Price: \$599
Media: Blu-ray drive
CPU: AMD Jaguar eight-core
GPU: Radeon HD 7790 equivalent
Memory: 8GB DDR3
Storage: 500GB HDD
Ports: USB 3.0 x 2
Required internet connection: No
Backwards compatibility: No

Xbox One
INFO





Wii U

Wow, this is going to be one hard sell. The Wii U is already available worldwide so it can't really be considered a true next-gen machine, but looking at its incredibly modest specs – the highlight being its Espresso CPU that only marginally outperforms the original Wii's – you wonder if it even has the chops to keep up with Microsoft and Sony's current-gen workhorses. OK, it's backwards-compatible with Wii games and doesn't use a camera to spy on your every movement. It's also considerably cheaper than any other system we're covering in this feature, but with new releases for Nintendo's 'next-gen' platform already dwindling, this couldn't look more like a misfire if they tried.

Wii U INFO

Manufacturer: Nintendo
Release date: Out now
Price: \$349/\$429 (Premium)
Media: 25GB Optical proprietary
CPU: IBM Espresso three-core, 1.2GHz
GPU: AMD HD 4800 equivalent, 549MHz
Memory: 2GB DDR3
Storage: 8GB flash/32GB flash (Premium)
Ports: USB 2.0 x 2
Required internet connection: No
Backwards compatibility: Yes (Wii)

tinkering that elevates the PC beyond the closed platforms of next-gen. Yes, APUs are much trickier to overclock than Intel's pre-Ivy Bridge architecture, but damn it all if we won't find a way. There's a world of aftermarket cooling out there that'll let you squeeze more out of an AMD A4-5000 than either console could dream of – even factoring in the benefits of producing a closed, 'optimised' platform.

We have another age-old ace up our sleeve: the ability to pop open the case and install new kit. While it's over two years old now, Intel's i7-2600K Sandy Bridge chip will blow away AMD's Jaguar on any performance benchmark. It's still \$350 to buy new, but the older option is there if you need to prioritise CPU performance. Sony and Microsoft need to compromise in their selection of silicon, factoring in price and limited cooling space. PC system builders need not.

TRIPLE YAY

It's doubly good news for the PC that all the platforms are singing from the same hymnbook, at least when it comes to architecture. Firstly, it means developers are going to be happier producing games across all platforms than they currently are. Sony's CELL processor has been an impressive workhorse for the past seven years, but by all accounts, coding for it is like reciting Proust in Mandarin while riding a unicycle over shark-infested waters, compared to the relatively similar PC and Xbox 360 environments. PC Gaming Alliance president and Intel senior product planner Matt Ployhar informs us: "It's my understanding that PS3 uses a flavour of [Open]GL, whereas the Xbox uses some flavour of DX9."

This has meant that "Sony has struggled with making devs happy" on PS3. Resources that might have been better spent improving the core gameplay were instead channelled into getting the damn game to work on three different machines. In some cases, like *Deus Ex: Human Revolution* and *DmC: Devil May Cry*, that meant outsourcing the PC port to a third party – Nixxes Software BV and QLOC, respectively. In other worse cases, like *Grand Theft Auto IV*'s, it's meant waiting seven months for a sub-standard PC port with a lower frame rate than a flip book. The similarities between eighth-gen consoles and PC architecture will minimise any further repetitions, which is good news for all parties.

While the PC's relationship with triple-A titles appears set for reconciliation, its strengths in the games market remain the same: multiplayer, endless backwards compatibility and an incredible indie scene. Both Sony and Microsoft are charging monthly fees to access games online this generation, Sony execs having presumably watched incredulously as people actually agreed to shell out for a basic gaming experience on Xbox Live and said "damn, we need to get in on that". The Xbox One's permanent internet connection – even to play single-player games – was hastily retracted after much internet mud-slinging, but it remains an eloquent indication of Microsoft's long-term vision.

Console fans were perhaps so jaded by seventh-gen's refusal to allow old games to be played on new hardware that there was barely a backlash when neither Sony nor Microsoft confirmed their eight-gen machines would have the feature. Only Nintendo included backwards compatibility in the Wii U, letting you play your Wii games on the new hardware (because otherwise the Wii U would have no games). There's always HD remakes available over the PlayStation Network and Xbox Live, of course – a clever way to get you paying for your favourite games twice. To a PC gamer accustomed to loading up *Day of the Tentacle* on DOSBox, it's like reading dystopian science fiction.

Ployhar points out that as PC hardware improves, older games feel the benefit. He uses the maligned DirectX 10 hardware generation as an example: "If memory serves, the DX 10-capable cards were also incredible DX 9 cards. While most people look at this as a double-edged sword, another way of potentially looking at this is that it's a dual-mode card. In the console world, that'd be the equivalent of truly being able to play all of one's Xbox 360 games on an Xbox, or the entire portfolio of PS2 games on a PS3. The DX10 cards, on the other hand, typically played one's DX9 games better than some DX10 content at the time."

If the PC domain is the heart of the indie scene, Microsoft and Sony are the conspicuous squares turning up to the gig wearing the band's T-shirt and slightly-too-new Converse All-Stars. Both at least acknowledge that this whole indie 'thing' is kind of important; Sony signed up *Braid* creator and agent provocateur Jonathan Blow for a first-party game called *The Witness*, while Microsoft has Notch working on a bespoke *Minecraft* for Xbox One. But of the two, Sony appears to be more indie-friendly. "It's obvious Microsoft is going for the 'DudeBros'. The TV-watching demographic," says bitSmith art director Basil Lim, whose game *Ku: Shroud of Morigan* is the subject of talks with Sony for a PS4 release. "And that's totally fine, that's up to them. But there's huge money to be made in the indies. Even the triple-A studios have really upped their game this year and I think that's a direct response to the innovation that indie studios are bringing. I think Sony's totally right to be focusing in this area."

Minecraft is the Ryan Gosling of video games and as such, an Xbox One exclusive version sounds like a pretty big deal, although it's a myopic



Will the next-gen consoles be able to match the PC with titles like *Battlefield 4*?

NUC

business move from Microsoft that shows its misinterpretation of Notch's phenomenon as a blockbuster title, not the grassroots cultural phenomenon it is. Notch's next big thing, *Ox10c*, might be as popular (it's on hiatus at the moment anyway), but in all likelihood the next *Minecraft* won't be a *Minecraft* game or even a Notch game – it will emerge from Indiegogo, Steam Greenlight, a Rezzed booth or from a fascinating prototype dropped into a games blogger's inbox. It's an infrastructure the console manufacturers can't catch up with by redesigning the indie page on their online store, which means in the next generation, we'll still get the most inventive, trail-blazing content on the PC first, because we're special and we deserve it.

So we've officially won games. You can all go home now. Except, what if you wanted to do more than play games on your machine? Judging by the number of times it was mentioned during the Xbox One reveal, you get the feeling Microsoft's offering might be alright at TV. In fact, its UI shares snap functions with Windows 8, letting you run video, Skype or IE in Picture-in-Pictures at the corners of the screen. Finally, a home media system that lets you run more activities onscreen than you could ever pay attention to. And it's all controlled by Kinect, the flawless remote control alternative that shut down viewers' 360s mid-Xbox One conference whenever anyone said "Xbox off" on stage. Flawless.

In all seriousness, the Xbox One looks flashy and futuristic, but it doesn't offer anything substantial beyond even a humble home theatre PC running Windows 8 except voice recognition. As for the PS4, it's not pushing TV quite as hard, although it does support 4K resolution like the One, so you're in for some future-proof, crisp video playback when tech catches up to the new HD standard. You can then find a buyer for that extraneous second kidney and free up some extra moolah for a 4K TV.

The problem on the video front comes from file format support. MKV videos are notoriously difficult to play on both the PS3 and Xbox 360, and while we've yet to find out if next-gen solves that everyday annoyance, it doesn't seem likely. So we're back to the Intel NUC again – a tiny home theatre system that'll play any file you can name, for around the price of a PS4 if you already have an mSATA drive.

In fact, it's the steep pricing of both consoles that really takes the edge off any anxiety. They're both impressive tech packages for under \$600 that'll offer years of entertainment, but with each year both closed platforms will fall behind advances on the PC side. Intel's NUC DC53427HYE (less catchy than PS4) is only the start of a move towards ever smaller form factor systems with more functionality than a console, and in the next few years, more graphical firepower.

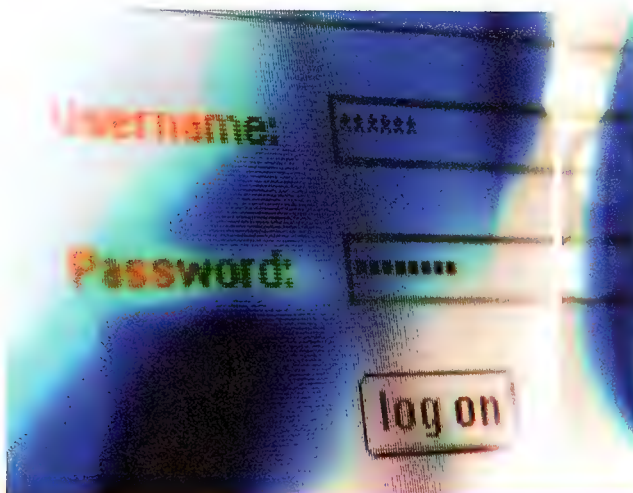
As it stands, the eighth generation of consoles looks great for the PC faithful. The brightest new developers still come to the PC first, as does the brightest new tech. Hell, you don't even have to talk to an always-watching camera to load a game – now there's a futuristic notion. **ADC**

There's a lot to like about Intel's flagship NUC: the price and the powerful 'system-on-a-chip' CPU, which packs a surprising graphical oomph along with four CPU cores and L3 and effectively L4 cache layers. There are extra costs involved in getting the system running, however. You'll need to shell out for your own memory and storage, for a start. And while its lack of physical media support could be considered very forward-thinking, it also means loading an OS via a USB flash drive and downloading all your games and media onto an SSD, which still doesn't boast the sheer byte-for-byte value you get with more traditional mechanical storage.

NUC INFO

Manufacturer: Intel
Release date: Out now
Price: \$499
Media: Blu-ray drive
CPU: Intel Core i5-3427U
GPU: Intel HD 4000, 350MHz – 1.15GHz
Memory: Up to 16GB DDR4 (none included)
Storage: mSATA SSD (none included)
Ports: USB 3.0 x 1, USB 2.0 x 2
Required internet connection: No
Backwards compatibility: Yes





HIDDEN 'LOGOUT' BUTTONS

Sometimes those sneaky buttons on web sites prove hard to find.

Is anybody else having trouble finding 'Logout' buttons on some web pages? Every secure web site that needs to be logged into normally has a set of security guidelines, one of which is 'Ensure you correctly logout at the end of your session'.

While the 'Login' button is usually right there in front of you clear as day, it can be almost impossible to find the 'Logout' button on some web pages. It seems the web site designer assumes you love their site so much you will never want to leave.

There's no convention as to where it's located or what it looks like. Banks, shopping sites, utilities, even government portals are all as bad as each other. Some are in a small font right at the very top, or just an entry in a long sidebar menu or placed so far down a web page it is necessary to scroll down to find it. A few sites even require you to click on a submenu to find it!

There should be a great big 'Let me outta here!' button that you can't miss. Surely I am not the only one who finds this annoying?

Gordon White

HDD BOOTUP FIX

I too had Stevan Holt's problem in getting a 'BOOTMGR not available' message at bootup ('Quick tips', APC August, page 73). My problem was easy to rectify, but exceedingly frustrating to diagnose.

I had Windows installed on a 'green' HDD and it would boot only at every second press of the 'Start' button on my desktop. I scratched my head for weeks and used my entire repertoire of swear words before the penny dropped. It transpired that the BIOS had finished searching for the boot HDD before that HDD had finished initialising, so it was 'not available' on each first attempt, but had finished initialising by the second attempt.

The solution? The BIOS had been set to fast boot 'enabled'. Changing it to 'disabled' completely cured the problem. So, disable fast boot in the BIOS and avoid 'green' HDDs. The few cents a year they might save in electricity is not worth the hassles in longevity, reliability and speed.

Max Andersen

AUNT'S NEW TECH

My aunty (who is 91) decided it was high time to get on board with the new technology and get a laptop to send some letters via the 'electric thingy' so that she could stay in touch with some friends that she regularly communicates with by mail.

A few questions to her brother (my dad – the self-confessed PC illiterate of the last three years running) and his wife (the Bill Gates of the Brisbane retirement resort) suggests that the nephew (me – somewhat OK having been involved with PCs since the XT and before) help her out.

We got the laptop and a wireless printer. "How does the wireless work?", asks aunty. (OMG! Don't anyone answer.) "It comes from the internet," replies the Bill Gates stand-in. "Um, not really," I say and try to beat a hasty retreat from that line of questioning. "Whats that?" asks my aunt, as she points to the mouse. "How does that work?" (at this stage I'm looking for the rum bottle).

We switched the laptop on and I connected the printer via wireless. The mouse is functioning, albeit a little slowly, but we can turn on the PC and see stuff on the screen. I opted for the Telstra wireless internet because the ADSL at the resort takes some time to set up and I had to leave that day (thankfully!). The internet was set up and functioning, as well as Hotmail with a new email address for my aunt.

Then I ask my aunt who she wants to send an email to. "I don't know" she replies. OK, so we start up Microsoft Word, as the letter can be written in there as the 'experts' watch on and assure everyone that they can help if this is an issue down the track. I say my farewells and pity my son, as he is in his third-year IT degree in Brisbane, so he will get the first call for sure.

From the first to the tenth call, nothing is working... Long story short, the damned laptop was faulty! We sent it back and it got replaced. So then my aunt tells us, "The writing thingy [Word] is not setting the margins right". It only took a week to get the instructions to set the margins in Word, so we're all good there. Then the printer won't print, as it hasn't been set up with the new laptop. My son has some fun here, but it's OK in the end. Then she can't send emails. Bill Gates has tried this and yep, can't send anything! Credit is out on the dongle and education on recharging is not going so well.

Then a light pops on in brain! A quick trip to eBay and there it is: a replacement ribbon for the old Adler typewriter... Everyone's happy. My son is relieved and life in the fast lane gets off to a treacle start...

Maurie Williams

APCMAG@BAUER-MEDIA.COM.AU

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S E R V E R S



SAMSUNG CAUGHT FAKIN' IT

Benchmarks are a useful tool for gauging the performance of tech gear, but they're not always reliable — not even when it comes to devices like smartphones.



'Fake it till you make it' is the old adage that's meant to offer helpful advice on how to get ahead in business and potentially life in general. So what does it mean when you've clearly made it, but you still feel the need to fake it? That's probably one for the psychologists out there, but it's a question Samsung might want to think about asking itself, too: the Korean smartphone king was recently caught overclocking the CPU and GPU in its international Galaxy S4 handset to provide better performance in a range of common Android benchmarks.

The core findings relate to the GPU and were uncovered by a forum poster at Beyond3D (tinyurl.com/mak8t78) and then investigated by AnandTech (tinyurl.com/pxco245). AnandTech performed most of its testing on the octa-core GT-i9500 version of the S4, but found the GT-i9505 (ie. the official model sold in Australia) was also subject to CPU overclocking. There are still plenty of local importers selling the GT-i9500 outright in Australia.

The accusations are that in normal gaming apps, Samsung locks the S4's Adreno 320 GPU at a top speed of 480MHz. When it detects certain benchmarks running (Quadrant, AnTuTu and Linpack), that graphics chip gets instantly boosted to 532MHz, which returns a roughly 14% improvement in graphics performance. What's more, it looks like that behaviour is controlled by a Samsung app specifically designed to enhance benchmark performance.

Samsung hasn't been subtle in trying to hide it, with the commands sitting under a code section named 'BenchmarkBooster' and singling out the optimisations to apply to known benchmarks. Samsung has at least publicly responded to the accusations, but the statement doesn't really address all of the questions that the findings raise: "Under ordinary conditions, the Galaxy S4 has been designed to allow a maximum GPU frequency of 533MHz. However, the maximum GPU frequency is lowered to 480MHz for certain gaming apps that may cause an overload, when they are used for a prolonged period of time in full-screen mode." Samsung states that the 533MHz frequency is also available to other applications including the browser, gallery, camera and video player.

It's worth pointing out that one of the boosted benchmarks (GLBenchmark 2.5.1) has a specific battery life test that's designed to run continuously until the battery is drained, which typically takes a number of hours. That kind of testing must surely count as a 'prolonged period of time' that 'may cause an overload'? It's somewhat telling that in our own battery life testing using GLBenchmark 2.5.1, the Australian S4 didn't last as long as the HTC One — 2:25hr versus 2:38hr — despite both using the same GPU and Samsung having the bigger battery.

Of course, the PC is no stranger to faked benchmark results. Graphics card makers Nvidia and AMD have both been accused of adjusting their drivers to give better results in popular games and benchmarking programs over the years, often deliberately sacrificing image quality for the sake of frame rate. In the case of the S4, however, this is the first time we've seen a smartphone specifically overclock itself for the sake of one-upping the competition. And as Samsung itself has pointed out, that's likely to generate more heat and therefore risk hardware damage.

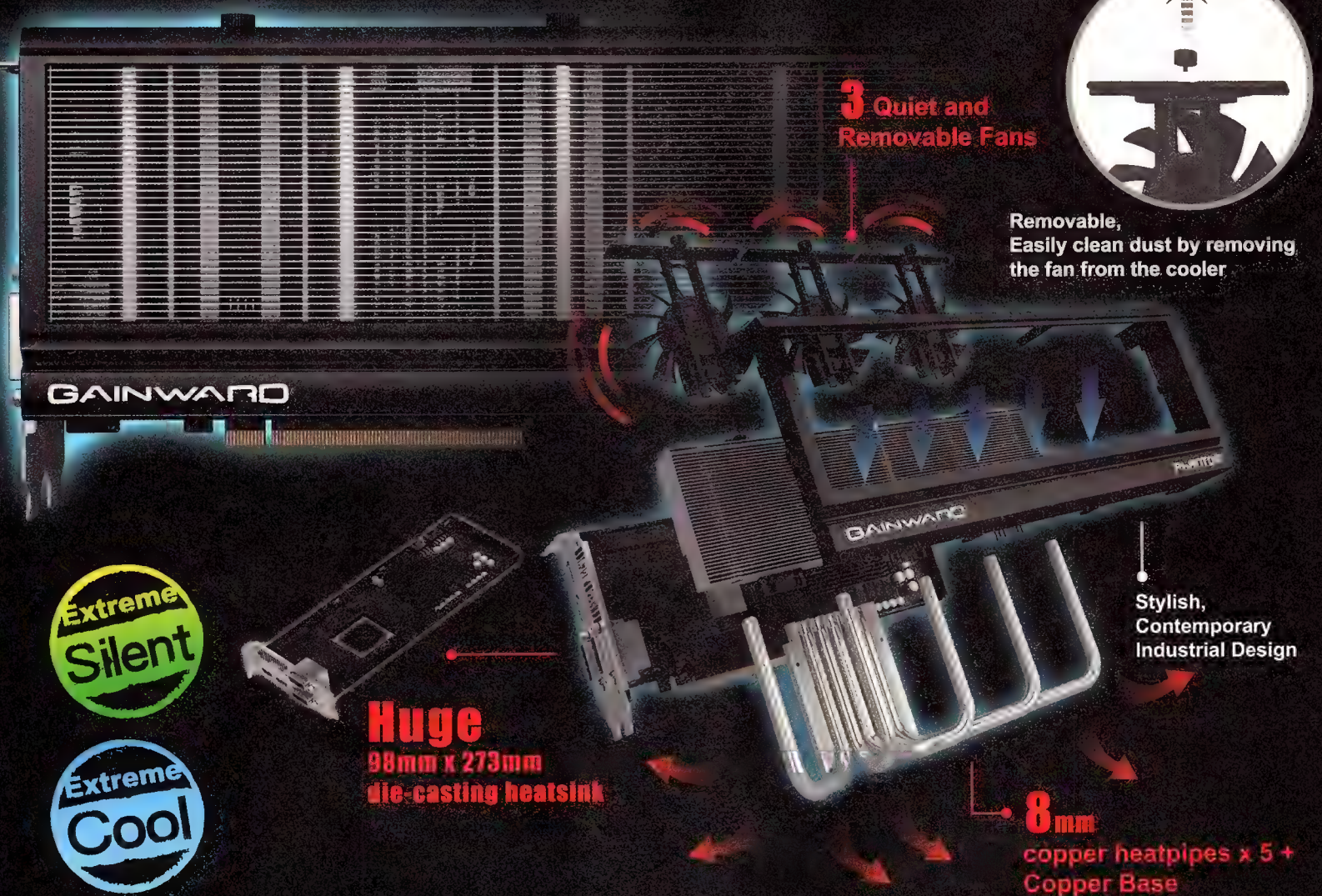
For most people, however, performance is only one small part of the equation when you're figuring out what smartphone to buy. Screen size and type alongside a phone's weight, build materials and general style would, we'd hazard, be bigger decision influencers for most people. Speed is a nice bonus to have, of course, and convincing smartphone enthusiasts that you have the faster product may win over some influencers (who may in turn then go out and evangelise your gear). It's interesting to note that despite the potential overclocking, we found that the HTC One often just felt faster and smoother in general usage when we reviewed the two phones back in our July issue (see page 28).

The current smartphone market is more volatile than ever. In the last year, smaller rivals have managed to claw back some market share from Apple and Samsung, which together account for 43% of sales, down from 49% this time last year. Samsung is clearly willing to use every trick in the book to maintain its leading position, but in doing so, it might just have alienated some of its most important customers: the enthusiasts and early adopters who care about performance the most. **BTDC**

ENDUSER

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GAMES

OUYA GAME CONSOLE

We delve inside the indie gaming machine.

BACKGROUND

Ouya's US\$99 Android-powered system is touted as 'the first totally open video game console' and comes complete with free software development tools. Here, we delve deep into the hardware that powers this little device.

MAJOR TECH SPECS

- Nvidia Tegra 3 processor
- 1GB RAM
- 8GB of internal storage (expandable via USB)
- Wi-Fi and Ethernet capability
- Bluetooth-enabled gamepad

KEY FINDINGS

- After removing a hex screw, the top panel comes off easily, revealing a clean and simple layout. The motherboard, I/O ports and fan are tucked in as a single assembly.
- Extracting the motherboard/fan assembly simply requires pulling it away from the case assembly.
- The fan is the only modular, easily removed component in the box – that's OK, it's also the only moving component, subject to wear. Held in by four Phillips screws and a plug, the fan is a standard, off-the-shelf part, so you can easily replace it.
- To remove the heatsink from the processor, our trusty soldering iron and desoldering wick was required. According to an Ouya engineer, solder was chosen over clips for mechanical strength, as they were (rightfully) worried about such a small console being knocked around or dropped.
- Onto the controller. Two pieces of the top casing of the controller easily separate from the body, no tools required – convenient for dropping in fresh batteries (two AAs). A few Phillips screws provide entry into the controller itself, where we find a stack of two circuit boards: the top hosts contacts for the directional pad and 'O', 'U', 'Y', 'A' buttons, while the lower is home to the two analogue joysticks.
- Underneath the top button board, we find a lone IC, charged with running the entire controller. The Broadcom BCM20730 Bluetooth 3.0 transceiver features an integrated ARM Cortex-M3 processor, capable of reading all of the button and joystick inputs and sending them off into the ether (or really, back to the Ouya console).
- The batteries are standard AAs and easy to access and replace without tools. Only standard screws are used (Phillips and hex), and many components are modular and simple to remove. The heatsink is soldered in place, so if you need to replace the thermal pad or repeated fan-swapping strips the threads, you'll need some soldering skills. The joysticks are soldered to the circuit board, so if your button-mashing gets out of hand, you may need to replace the whole board. **APC**





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Acer Aspire S7-392

A minor update to the S7-391.

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Expensive, plastic underside. ✗

Technically, this Aspire S7-392 from Acer is actually the second ultrabook based on Intel's new fourth-gen Core components (aka Haswell) that we've tested, the first being Apple's 2013 MacBook Air last month (see *APC* August, page 22). And you can tell by the model number change – bumping up from S7-391 to S7-392 – that Acer considers this refresh a minor update. In some senses, though, that's underselling the one big thing this new model does offer over the last generation: better battery life.

Physically, the S7-392 is basically indistinguishable from the S7-391, which we tested late last year (see *APC* December 2012, page 20). Both weigh in at 1.3kg and offer a very solid aluminium keyboard deck combined with a white Gorilla Glass 2 screen and lid. It's a tough yet stylish look that's only slightly undermined by the underside being plastic. The latter likely helps keep the weight down, but it will obviously show more wear and tear compared to the all-metal chassis you'll see from ASUS's Zenbooks or the aforementioned MacBook Airs.

The 13.1-inch, 1080p touchscreen is still great, with an IPS number that produces very natural colours and is exceptionally bright and clean. At this screen size, the resolution is high enough that individual pixels are virtually indistinguishable. Acer also seems to have tweaked the keyboard a little to improve on that in the S7-391 – the keys are raised a tad higher here and offer a little more resistance (we felt they were a little low and soft before), which certainly improves the typing experience and makes it easier to feel where the edge of each key is.

Under that chassis, the S7-392 is largely new, too, although it's honestly a bit of a mixed bag. This top-spec model has a 256GB SSD, 8GB of memory and a sparkling new fourth-gen

Core i7 processor, although the latter's basically the very bottom option out of the 14 or so mobile Core i7s Intel has on offer. What that primarily means is a lower boost speed (peaking at 3.0GHz), but also a lower-end GPU in the form of an Intel HD Graphics 4400 chip. That's a bit of a step down from the 5000 chip you'll find in higher-end mobile Core i7s and at this kind of premium price, you really should be able to expect the best.

In our benchmarks, those slight compromises do result in performance that's slower than the 13-inch MacBook Air we tested last month (we set up the latter to run Windows 8), in the range of around 10-20% for general performance. Still, that's not something you'll often notice when doing basic tasks like surfing the web or working on office documents, and the Aspire still arguably delivers where it counts, with very respectable battery life.

With the screen at 50% brightness, this S7-392 managed to last 7:16hr in our video playback benchmark test. While that doesn't quite live up to the battery life we saw on the aforementioned Air, which reached 7:51hr, it's significantly better than the roughly 4:30hr we saw in last-gen ultrabooks. And Acer isn't gilding the lily with its battery life claims, rating this one as capable of up to 8 hours of runtime. Turn that screen brightness down a little lower and that should certainly be achievable.

While we're still not completely happy with the RRP Acer has slapped on this one (especially considering the top-spec MacBook Air is going for \$300 less with a 512GB SSD and better CPU/GPU), this is undoubtedly a very fine Windows ultrabook. And finally, it's one that also might be able to last you a full working day.

Dan Gardiner



7/10 Toshiba KIRA

Too sharp for its own good?

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Superb display, magnesium alloy chassis, petite size. ✓

Graphics scaling problems in Windows, uses last year's core hardware. ✗

Toshiba's KIRA is the laptop that's been widely touted as the Windows answer to Apple's Retina MacBook Pro, a petite little unit that squeezes a super-high-definition 13.3-inch screen into a body that makes most other 13-inch ultrabooks look oversized.

The KIRA's small footprint is largely made possible by a thin bezel around the screen and a slightly narrower keyboard, though only by a centimetre or so compared to other 13-inchers. The chassis is largely constructed from a magnesium alloy, but while it looks metallic, it doesn't really feel it. It's not quite as cool to touch as aluminium, nor quite as rigid when it comes to the lid. It's worth noting too that underside is just plain old plastic, which won't be able to take as much wear and tear.

That said, the rest of the build does live up to the premium stylings. There's a big trackpad that has a nice, clean click action, but that's also pleasingly dampened when you hit the bottom. And while the keyboard keys aren't quite square as on many of these Air clones – meaning they're a little shorter in height – they do have plenty of space around them. Despite their smallish size, we didn't have particular issues with typing accuracy or speed.

While the KIRA's screen doesn't jam in quite as many pixels in as Apple's 13-inch Retina MacBook (which boasts a 16:10 aspect ratio display at 2,560 x 1,600 pixels), the KIRA does come close, using a 16:9 screen at a still impressive 2,560 x 1,440. As you'd expect, that screen is pin sharp, with not a pixel to be spied anywhere and with the right kind of content (such as 20MP+ still images), it's capable of an

incredible level of detail. It's also exceedingly well-balanced in terms of colours – they're vivid and rich without being fluorescent or unnatural.

Unfortunately, Windows 8 isn't able to really make the most of that screen, with the OS's graphics scaling capabilities being rather pressed by such a high resolution at this small physical size. Even with Toshiba's custom scaling setting of 165% (Windows offers 100%, 125% and 150% by default), that high resolution can render some onscreen elements – such as interface buttons that are only coded to exist at one size (the playback controls in Windows Media Player, for example) – at a minuscule scale. Some programs can deal with this – in Google Chrome, for example, you can dig into the settings to fine-tune the scaling to a good degree – but many aren't quite so flexible, which means you'll often just need to live with things being smaller than you'd probably like.

The timing of the KIRA's launch is a bit off, too. With ultrabooks using Intel's fourth-generation Core tech starting to creep into the market, the year-old third-gen kit on offer here isn't quite so impressive. While its Core i7 processor, 8GB of memory and 256GB SSD are still competitive, some of the battery life results were less inspiring. The fourth-gen-equipped Acer Aspire S7 we also tested lasted a whopping 2.5 hours longer in our video playback battery test, managing 7 hours to the KIRA's 4.5. That alone may be enough to make most people ignore this unit's other charms.

Dan Gardiner



LABS BENCHMARK RESULTS

GIGABYTE BRIX BENCHMARKS



*Average transfer speed: 140.42MB/s

7/10 Gigabyte Brix

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When Intel introduced the palm-sized Next Unit of Computing, or NUC for short, we stopped and considered how it would fit into current and future computing. We obviously weren't the only ones who took notice, however, as Gigabyte has just launched its own take on the NUC, which it has named the Brix.

Despite sounding like it should be a fibre-filled cereal, the Brix is quite a solid little computer. We tested the GB-XM11-3337U model, which uses roughly the same 10 x 10cm form factor as the NUC, as well as Intel's HM77 chipset and a Core i5-3337U CPU that buzzes along at 1.8GHz and boosting up to 2.7GHz. While it can hold up to 16GB of RAM in dual slots, the Brix doesn't come with its own memory; instead, we installed 8GB of Corsair DDR3. And also like the NUC, rather than taking a laptop SATA drive, the Brix uses mSATA. While this does essentially limit your HDD options to mSATA, SSDs are gaining in popularity and subsequently dropping in price. We tested it with a Kingston 120GB mSATA drive. The Brix even includes a half-size mini PCIe slot, which is occupied by an included 802.11n Wi-Fi card. There's no way to install a discrete GPU, so you have to rely on the integrated Intel HD Graphics 4000 chip.

Installing the RAM and mSATA drive is dead easy. You undo four screws, pop the bottom cover off, drop in the upgrades, whack the cover back on and you're good to go. If you want to delve further into the Brix, just two screws hold the motherboard in once the cover is off. We installed Windows 8 directly off a USB 3.0 flash drive and were up and running in under 10 minutes. It's also worth noting that boot

time from power off to ready to rock is just 10 seconds.

For the most part, using the Brix feels just like a mid-range laptop – it's fast, responsive and can handle all your day-to-day tasks. It's no gaming machine, although the HD 4000 graphics can adequately run older and less demanding titles, and also handle HD video like it's not even there. Under heavy load, the fan in the Brix does spin up to keep it cool, but even then it's still quiet enough that you won't hear it unless you get very close.

The Brix includes a single USB 3.0 port on the front panel, which is especially handy for those who want to use it as a media player. It's also got another USB 3.0 round the back, but we can't help feeling that at least one more would have been useful. Video output is via HDMI or mini DisplayPort and it's worth noting that no cables or adapters are included. In addition, you get a Gigabit LAN port, DC input socket and Kensington security lock slot.

The external power brick is the same 65W 19V adapter you see on many laptops, making it easy to replace if need be. The Brix uses fairly low power – we measured 26W from the wall at the highest and just 16W when surfing the net.

For those who want to do more with the Brix than leave it sitting on a desk or shelf, it also comes with a VESA mounting bracket that supports both 75 x 75 and 100 x 100mm mounts.

The Brix is a great take on the Intel NUC form factor and while it's not yet a budget alternative, it's potentially a great little option for use as a low-power PC, home server or even a home theatre PC.

Lindsay Handmer

The logo for the video game "Sleeping Dogs" is a shield-shaped emblem. It features the words "SLEEPING" and "DOGS" in a bold, white, sans-serif font, stacked vertically against a dark background. The shield has a thin white border.

All NVIDIA graphics technology supports up to six DisplayPort™ monitors in an enabled graphics card. Supported display quantities, type and resolution vary by model and board design; confirm specifications with manufacturers before purchasing. See www.nvidia.com/US/DisplayPort for full details.
 Images for GeForce GTX 1080 Ti, GeForce GTX 1080, GeForce GTX 1070 Ti, GeForce GTX 1070, GeForce GTX 1060, GeForce GTX 1050 Ti, GeForce GTX 1050, GeForce GTX 1040, GeForce GTX 1030, GeForce GTX 1030 Ti, GeForce GTX 1030 2GB, GeForce GTX 1030 4GB, GeForce GTX 1030 6GB, GeForce GTX 1030 8GB, GeForce GTX 1030 12GB, GeForce GTX 1030 16GB, GeForce GTX 1030 20GB, GeForce GTX 1030 24GB, GeForce GTX 1030 32GB, GeForce GTX 1030 48GB, GeForce GTX 1030 64GB, GeForce GTX 1030 96GB, GeForce GTX 1030 128GB, GeForce GTX 1030 192GB, GeForce GTX 1030 256GB, GeForce GTX 1030 384GB, GeForce GTX 1030 512GB, GeForce GTX 1030 768GB, GeForce GTX 1030 1024GB, GeForce GTX 1030 1312GB, GeForce GTX 1030 1638GB, GeForce GTX 1030 2048GB, GeForce GTX 1030 2560GB, GeForce GTX 1030 3276GB, GeForce GTX 1030 4096GB, GeForce GTX 1030 5120GB, GeForce GTX 1030 6400GB, GeForce GTX 1030 7936GB, GeForce GTX 1030 9920GB, GeForce GTX 1030 12400GB, GeForce GTX 1030 15500GB, GeForce GTX 1030 19440GB, GeForce GTX 1030 24350GB, 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8/10 EVGA GeForce GTX 770 Superclocked

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One of the only issues we have with the GTX 770 concerns Nvidia's decision to drop the lovely trivalent chromium-plated cooling solution from the GTX Titan and 780 onto it. We had no problem with the level of cooling it affords or with the look – it couldn't look any more bling unless it had a diamond-studded hubcap in the middle of the fan housing.

Our problem is that the only way for card manufacturers to differentiate themselves is to design own-brand cooling solutions and slap them onto their cards, maybe with a hefty overclock to boot. And that's exactly what EVGA has done with this Superclocked version of the excellent GTX 770.

So instead of the matte-finished, LED-lit, robust Nvidia cooler, EVGA has gone with its brand-new ACX cooling array. Rather than the chromium plating, we've got plastic surrounds and a couple of chunky fans. We'd be shallow if our concerns around a new graphics card launch were about its aesthetics alone, but no matter how good the cooling performance of such a replacement chiller on either a GTX 780 or GTX 770 is, they're going to suffer by visual comparison.

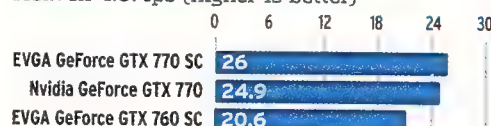
And that's a shame because the ACX cooling is really quite impressive on these Superclocked cards. Like EVGA's GTX 760 version, this GTX 770 iteration manages to chill the GPU down by at least 10°C. The stock cooler, as good-looking as it is, still gets rather hot when you apply some serious graphics loads. We were knocking around 80°C with the Titan-esque cooler at 100% GPU load; on the other hand, this Superclocked card was sitting resolutely at 69°C.

We couldn't spot much difference in general acoustic levels with the out-of-the-box settings – the top-end Nvidia reference cooler is pretty good regarding standard noise

LABS BENCHMARK RESULTS

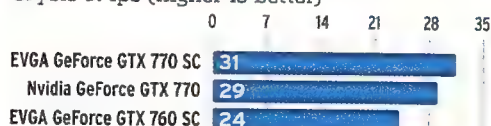
DIRECTX 11 TESSELLATION PERFORMANCE

Heaven 4.0: fps (higher is better)



DIRECTX 11 GAMING PERFORMANCE

Crysis 3: fps (higher is better)



ACX COOLING PERFORMANCE

100% GPU load: °C (cooler is better)



levels. The chunkier fans mean the ACX cooler doesn't have to spin up so quickly to dissipate the heat, so it shouldn't hit the same top-end noise levels.

But what about the actual gaming performance of this factory-overclocked card? The standard GTX 770 is already impressive, batting ahead of the GTX 680 it's essentially replacing, although GTX 680 prices have started to fall in the last few weeks. In real terms, this Superclocked card doesn't really offer much in terms of extra gaming chops, compared with the reference card, which can easily be pushed up to the same levels as this pricier version.

What you do get for the extra cash you're spending on EVGA's Superclocked GTX 770 is a card that can hit those top clocks without melting the silicon inside your GPU. It'll happily run at the enhanced clock speed, at lower temperatures than the standard card can manage running slower. Combined with EVGA's warranty support, this overclocked card is worth a look for that impressive ACX cooling alone. As long as you don't mind ditching the chrome, that is.

Dave James

M5 Pro SSD Xtreme

Uncover your true potential!

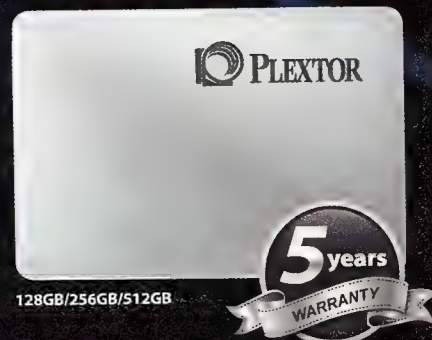
Upgrade with a Plextor SSD and experience 30% more efficiency



- Random read and write : up to 100,00/ 88,000 IOPS
- Sequential read and write : up to 540/470 MB/s
- Sustained high performance technolog delivers real world benefits and prevents SSD speed drop



- Highest data protection with exclusive True Protect Technology
- Support full AES-256 bit encryption
- Mean time between failures of 2.4 million hours
- Zero-error standard after 500 hours of the toughest endurance testing



The SSD Review
Gold Seal Award



7/10 Patriot Gauntlet Node

The DIY answer to Seagate's Wireless Plus.



WIRELESS HARD DRIVE

- www.patriotmemory.com @
- \$105 \$
- Flexible capacity, highly portable and compatible, user-friendly for tablets or smartphones. ✓
- Limited battery life, takes up a Wi-Fi connection. ✗

Patriot's Gauntlet Node looks pretty much like any other hard drive enclosure, but the secret to this one is that it'll allow anyone to convert a 2.5-inch laptop drive – up to a bulging 2TB – into a wirelessly-accessible block of storage. It's essentially the DIY version of the Seagate Wireless Plus below, pitched primarily at tablet and smartphone owners who want to bulk up their available storage.

The Node's onboard 802.11n Wi-Fi operates as its own little network, letting up to eight devices connect and access data wirelessly. It's primarily good for storing media files – photos, TV shows and movies – although it won't let you do things like install mobile apps. If what you're after is media storage, though, from a cost-per-GB basis the Node is clearly a much cheaper investment than opting for a device with more onboard storage (the difference between a 16GB and 64GB Wi-Fi iPad with Retina display is currently around \$220, for example).

Patriot provides free iOS and Android apps for accessing

the device; we found it to be reasonably user-friendly and easily accessible. However, there are some limitations worth noting. While there's an onboard battery, a fully charged Node can't quite last a full working day if pushed hard – only around 5.5 hours of continuous data streaming. The performance of the Wi-Fi transfer speed was also average in our tests, sitting at around 2.2MB to 2.5MB. That said, the Wi-Fi range was reasonably impressive, with the difference in data transmission speed being minimal whether it's right next to you or 15m away. You can also choose to connect the Node to a PC via USB cable, as it also has the option of USB 3.0 for faster file transfer, though that's not particularly helpful to USB-less smartphones and tablets.

All in all, the appeal of Gauntlet Node is really in its portability and the ability to BYO hard drive. If you'd like to take your media collection with you everywhere, this one does an adequate job.

Daniel Cheng

8/10 Seagate Wireless Plus 1TB

A hard drive that shares itself wirelessly makes sharing simple.



WIRELESS HARD DRIVE

- www.seagate.com @
- \$229 \$
- Compact size, 10-hour battery life, DLNA and AirPlay support. ✓
- Limited range. ✗

Seagate's Wireless Plus is a portable hard drive that points to a new direction for mobile storage: the personal cloud. The idea of the personal cloud is the ability to access your files from any device in your home or possibly even across the internet. You can see this in slightly different guises with some other recent hard drives – the Toshiba Canvio Connect's bundling of Pogoplug, for example, as well as in Western Digital's My Book Live desktop drives, which run a little server to offer always-available web access.

In the Wireless Plus, we have an interesting twist on that. This is a portable, USB-powered drive with an inbuilt 802.11n (150Mbps) wireless access point. Devices – including mobile devices with a dedicated Seagate app installed – can connect to that access point and play or run any of the files stored on the drive. The beauty here is that you don't need to sync your media with your mobile device – you just put it on your Wireless Plus and then use the app to access it directly.

The Wireless Plus weighs 256g and that includes a battery, which will last for around 10 hours between charges according to Seagate. We found the wireless range to mobile devices a little limited in our testing. On a Motorola Xoom Android tablet, we had trouble maintaining a good connection even one room away, but for media streaming in the same room, it worked seamlessly, even for HD content. At 5m, a 720p video played without a hitch, which is good news if you want to carry a big collection of HD media on the road with you, but don't want to have to take your laptop as well.

Nathan Taylor





9/10 BenQ XL2411T

A brilliant TN panel? Sounds like an oxymoron to us...

MONITOR

www.benq.com.au @

\$430 \$

Excellent screen, fully adjustable stand, easy-to-use OSD. ✓

The bezel's design is somewhat uninspiring. ✗

So, we've established that 3D is dead, right? Good. And we've also established that the only thing that would have us accepting a TN panel over an IPS one is the beauty of a high 120Hz+ refresh rate, right? With the ASUS VG248 (see APC May, page 28), we established that paying over \$450 for a 24-inch screen – even if it does have a 144Hz headline spec – is something we just can't get behind. With all those foundations firmly established, all BenQ needs to do with a new gaming screen is chop out the integrated IR receiver and bundled 3D goggles, hack up the asking price and supply a monitor with a high refresh rate and an excellent TN panel.

Sound like a lot to ask? Well, BenQ knew what we wanted before we even asked and has sent us the new XL2411T to play with. And it's just, well, brilliant. It may be only \$40 cheaper than the equivalent 24-inch 144Hz screen from ASUS, but there's not a hint of budget aspiration in sight. This is a great screen, with top TN technology inside it and all for an excellent price.

BenQ's XL2420T and TX screens were great examples of quality 3D-capable monitors. The XL2411T has cut out a few of the luxuries; namely, that funky little profile switcher and the natty red and black stand. However, when the panel is this good, we can happily forgo the pleasures of a splash of red and a mostly unnecessary breakout controller for our screen.

The XL2411T still has a fully adjustable stand, allowing you

to rotate the display 90° for portrait mode, and it's VESA-compatible, unlike a lot of the IPS screens we've seen recently. BenQ has also carried over the design decisions it made for the onscreen display (OSD) on its pricier panels. Instead of being side-mounted, the controls are in the more familiar location under the bottom bezel and they're still context-sensitive, displaying on the screen what the buttons do in any situation. BenQ has nailed the OSD and we hope other manufacturers are taking notes.

But it's not just the price and design that have impressed us – the quality of the display itself is fantastic. It's got that lovely 120Hz smoothness to everything you do on the desktop and because of the improvements in TN tech, the image quality is great, too. The contrast is excellent, the black levels are impressive and the white saturation is solid, if not perfect. There's also minimal pixel-walk and zero banding in the colour gradients. Compared side by side, it looks to be a better panel than the ASUS VG248, despite being lower in price.

The XL2411T is the most affordable 120Hz screen we've seen so far – being only just north of \$400 – and it's arguably one of the best-quality ones. The design of the panel's surrounds may be less inspiring than a motivational video, but it's more than functional and it has that excellent screen. Thankfully, we can forget about 3D and enjoy this brilliant TN.

Dave James

9/10 Zowie FK

Will make you want to LAN party like it's 1999.

MOUSE

www.zowiegear.com @

\$59 \$

Low price, great feel, solid performance. ✓

Not as flexible as laser on different surfaces. ✗

US gaming mouse maker Zowie takes a different tack to most. Rather than chasing ever-higher dpi settings and cramming its mice with features you won't use (more buttons, weight customisation, on-the-fly sensitivity changing, not to mention forced installs of increasingly bloated driver software – yes Razer, that was a reference to you), it's seemingly content to focus on core performance and comfort, and the FK is a fantastic example of how that can pay off.

Topping out at 'just' 2,300dpi, the FK's Avago 3090 optical sensor may not sound cutting edge, but many pro gamers – particularly first-person shooter players – actually prefer the older optical tech, supposedly because it has better stability than laser when swiped at very high speeds. If you've seen the gigantic, beach towel-sized mouse pads those guys use, you can understand why that may be desirable.

Even for us mere gaming plebeians, however, the FK still has appeal for a few key reasons: it's cheap, it's comfortable and it's more than fast enough for even twitch gamers who like super-high sensitivity. The FK is a smaller mouse that's best suited to gamers who use a claw grip and it's essentially

the same as Zowie's older AM when it comes to performance, offering three hard-coded dpi sensitivity settings (450, 1,150 and 2,300, switchable via a button on the bottom) as well as three polling rates (250Hz, 500Hz and 1,000Hz). Surprisingly, we found that even at the medium settings of 1,150dpi and 500Hz, it was more than fast enough to use on a 2,560 x 1,440-pixel monitor, offering a good balance of physical comfort and precision.

Of course, optical sensors do still have downsides: a tiny bit of fluff getting wedged in front of the sensor can render the FK inoperable and it doesn't work particularly well on irregular or unconventional surfaces. In fact, for gaming a dedicated mouse pad is basically essential. I'm sceptical enough to admit that it could all be in my head, but the FK does genuinely feel smoother and more stable than most of the laser mice I've used for the last eight odd years. And the fact that it achieves that for \$59 means I can't see myself ever going back to the latter – no matter how many dpi manufacturers manage to cram in there.

Dan Gardiner

6/10 Plantronics GameCom Commander

An exercise in function over an unendurable military form.

HEADSET

www.plantronics.com/au @

\$249 \$

Competent 7.1 adapter, fantastic mic, slick packaging. ✓

Pricy for the sound quality, uncomfortably clamped fit, non-braided cables. ✗

The utilitarian design of this limited edition GameCom Commander screams military. That starts with customisable velcro patches, an oversized mic and sturdy wire frame to support those massive cans, but even extends down to the screw-gate 'biner attached to the rugged carry case. Every detail is perfect and feels just like it's been looted from a downed Black Hawk.

It turns out that's all for show, however, as using the Commander is a different story. On the head, it's brutal to wear for long periods, thanks largely to the aggressive arc in the headband which clamps the headset migraineously into your skull. If that's not enough, the wire can extenders seem unwilling to sit precisely where you want them and instead slowly creep down its supports until it starts awkwardly tugging your ears south. It does eventually find a settling point, but we're of the opinion that at this price point a headset should be instantly comfortable.

The Commander also features a quick-release buckle part of the way along the non-braided cable, which allows you to switch the coiled 2m PC cable for a much shorter 3.5mm headphone cable. Sadly, the mic isn't detachable, so we're predicting these will never leave the house.

Thankfully, the headset's performance outstrips its fit, as the 40mm drivers, boasting a 20Hz to 18kHz frequency response, sound great and can be pushed hard without distorting the source.

On a gaming front, we took them for a spin through

Battlefield 3, *BioShock Infinite* and *Metro: Last Light* and were impressed with the quality of sound and the sound field delivered, especially given that they're closed cans. The optional 7.1 USB sound card adds an extra touch of dimensionality for those who want more precise audio accuracy. Musically, the Commander sounds great, too. There's a nice thick bottom end that punches through nicely and doesn't overpower the trebles through the middle. We noticed some slight weakness in the upper end trebles, though, but that might just be age. Ultimately, while it looks and sounds great, given its comfort deficiencies it's tough to really recommend the Commander; instead, we'd point you in the direction of something from Audio-Technica.

Troy Coleman



7/10 BlackBerry Q10

BB10 with an excellent keyboard.

SMARTPHONE

au.blackberry.com @

\$698 \$

Excellent keyboard, 4G capable. ✓

Tiny screen that's poor for touch and swipe gestures. ✗

BlackBerry's Q10 is very much a return to form for the smartphone maker, but then it would be – it's a phone with a keyboard and that's its clear and sole selling point above and beyond the entirely screen-based Z10. It's still a solidly designed 4G-enabled smartphone, with a premium feel that's ultimately quite similar to that of the Z10.

The weird thing is that while the keyboard is excellent as you'd expect for a BlackBerry, it's still running the same touch-enabled BB10 operating system as the Z10. BB10 is an interesting, information-centric operating system and that's still true on the Q10, but to a lesser extent than on the Z10. That's because in order to accommodate the keyboard and not create a smartphone the size of a brick, the screen has been shrunk down markedly.

As such, information display is a bit of a struggle on the Q10's tiny 3.1-inch 720 x 720-pixel screen, simply because there's just not that much space to tap or swipe. Web pages look tiny, as do photos or any other kind of information you'd care to peruse. When you do need to use a screen feature rather than a keyboard one, it's often a case of multiple taps to ensure accuracy, which isn't ideal.

It's clear why BlackBerry's made the Q10 – to appeal to



the long-term core BlackBerry crowd – but that makes it a smartphone that's pretty much only suited to that crowd. If you must have a keyboard, it's the best smartphone choice you can make right now, but it seems like a limited market.

Alex Kidman

9/10 Nokia Lumia 925

King for a day...

SMARTPHONE

www.nokia.com.au @

\$639 \$

Good camera, slick operation, excellent physical design. ✓

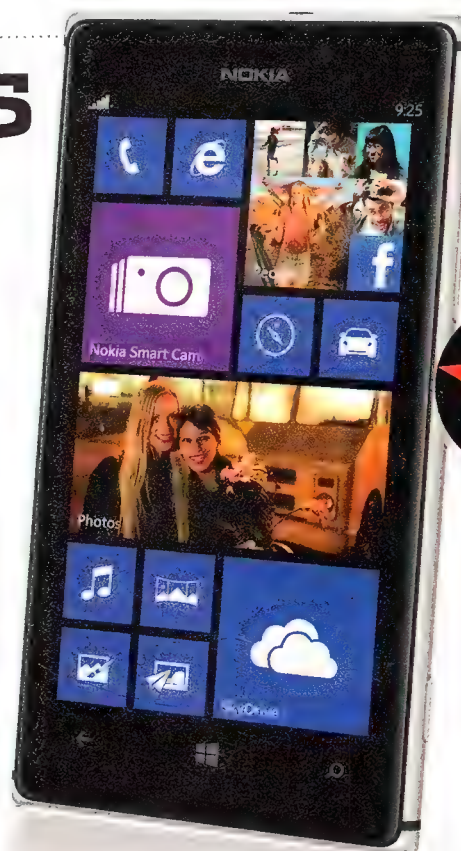
Fixed storage, low-resolution screen, better camera on the way. ✗

The Lumia 925 is an oddity. On the one hand, it's mostly a refinement on last year's good though thunderously chunky Lumia 920 design, which means you get Windows Phone 8, an excellent camera and solid battery life on a 4G smartphone. However, you get all that in a casing that's distinctly lighter by almost 50g, which means it's a lot more pleasant to use.

Photography continues to be Nokia's big smartphone calling card, with an 8.7MP sensor and Nokia's own Smart Camera photo application, which allows for layering effects, facial choices and object elimination based on taking multiple frames of a single shot. It works extremely well and the Lumia 925's low-light shooting is equally excellent.

The screen has changed from an IPS LCD on the 920 to an AMOLED on the 925, which is a little less impressive, and it's a sealed unit with only 16GB of memory if you buy from Telstra or Optus; Vodafone currently has the exclusive on the 32GB Lumia 925. Windows Phone 8 still isn't blessed with an abundance of apps, but its core tile-based system works well for those who want specific information or require in-phone access to Microsoft Office.

Still, the Lumia 925 is an oddity because Nokia would very much like you to pick it as the flagship Windows Phone 8 device, which it is... just not for long. And that's Nokia's own fault. We know the Lumia 1020 is coming with much the same internals, but an astonishing 41MP sensor. As

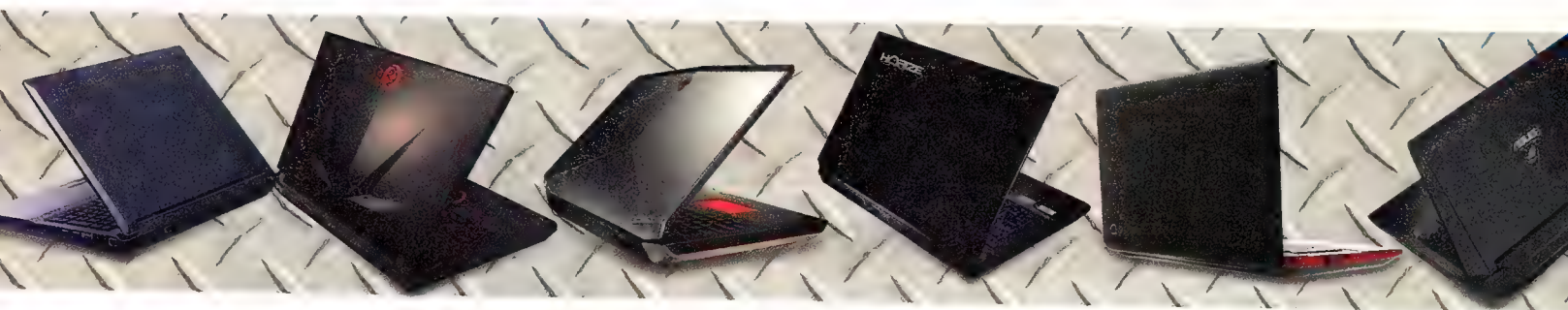


such, if you want the best Windows phone money can buy right now, this is the model to choose – but it won't be the best for all that long.

Alex Kidman

MOBILE GAMING FINALLY GETS GREAT

And as [Lindsay Handmer](#) discovers, you don't necessarily have to sacrifice battery life to get it.



If you're in the market for a gaming PC, the conventional wisdom has always been to make sure you're getting the absolute latest hardware. With Intel's recently launched fourth-generation Core CPUs, codenamed Haswell, that might not necessarily be true for desktop gamers, with Haswell offering little performance improvement over its third-gen Ivy Bridge predecessor.

However, the same can't be said for laptops. While many manufacturers are lagging behind when it comes to releasing laptops based on these latest parts – partially because of overstocked Ivy Bridge inventories – there are plenty of gaming laptops that do feature the new processors. If you want to pick up a laptop for gaming, Haswell has a number of advantages that makes it well worth seeking out.

Foremost, Haswell offers integrated power management to extend your battery life. In real-world terms, Intel claims that where your old laptop might be able to play HD video for 6 hours, with a Haswell CPU it would manage 9 hours. Idle power use is also reduced, more than doubling the time your computer can sleep for on battery. With lower power use, the fourth-gen CPUs also need less cooling, allowing faster CPUs to be shoehorned into smaller laptops. Performance still gets a small boost, too, and the while it's not much of a bonus on a gaming machine, the integrated graphics are more powerful.

Knowing whether a given laptop has a Haswell CPU is relatively simple: the number after i7 will start with a 4; for example, Intel Core i7-4700MQ, which you'll see in the lower-end gaming laptops. The next step up is the i7-4800MQ, which will cost around \$250 more, and then the high-end i7-4900MQ, which will add \$500 or so onto your base price. The faster CPUs are certainly quick, but in terms of bang for buck, they don't actually offer a huge amount of extra performance for your dollar.

While having a top-notch CPU is great, the majority of games will be

GPU limited, so getting the right video card is important. Nvidia chips are popular and of late it's been rare to see an AMD offering. For a budget gaming laptop, expect an Nvidia GeForce GTX 765M, while mid-range units will have a GTX 770M and high-end units a GTX 780M. The Radeon HD 8970M is a good performer, but it's outdone by the Nvidia GTX 780M.

One feature on new laptops that's gaining in popularity is mSATA. Using a smaller connector, mSATA is designed for SSDs that slot in like a stick of RAM. mSATA is a great way to add some super-fast SSD storage to your laptop without taking up a full-size drive bay. This lets you drop in a normal laptop hard drive for bulk storage.

There are a number of other extras that are worth looking out for. Gaming laptops all have HDMI outputs, so if you include a Blu-ray drive, they can double as a high-definition player. That said, PC game publishers haven't embraced Blu-rays; instead, they rely on games spanned across multiple DVDs.

Any decent gaming laptop will have a 1,920 x 1,080 screen resolution (Full HD 1080p), but there are a number of other factors to consider when it comes to the display. A handful of laptops use 120Hz screens that support stereoscopic 3D using active-shutter glasses, but expect to pay a price premium for these. Gaming screens are typically aimed at producing good response times, so accurate colour reproduction is often deemed unimportant. If your gaming machine will double as a graphics workstation, searching for a model with an IPS screen, which usually offers richer colours, is a good plan. It's also important to consider matte versus glossy screen finishes. Glossy screens tend to give a more vibrant image with better colour depth and contrast, but can suffer from issues with reflections unless they're used in a dark environment. Matte screens are better if you plan to use your laptop in your local coffee shop (or anywhere bright), but can lack the pop of their glossy counterparts.



i DUAL GTX770M GPUS
BACKLIT TRACKPAD
SLOT-LOADING DVD
DRIVE

6 10 Alienware 18

An oversized 18-inch gaming beast.

www.alienware.com.au @

\$3,499 \$

18.4-inch screen, SLI
graphics, Alienware
style. ✓

Expensive, heavy, poor
customisation options. ✗

If you crave sheer power and size over portability, look no further. The monster Alienware 18 might look like it comes from another world, but it runs familiar hardware. It's got a Core i7-4700MQ CPU that runs from 2.4GHz up to 3.4GHz and 16GB of DDR3 RAM. Unlike smaller laptops that are space and cooling constrained, the Alienware has room to squeeze in two GPUs in SLI; in this case, dual Nvidia GTX 770Ms with 3GB each of RAM. It also runs dual 7,200rpm 720GB HDDs in RAID 0, along with a 64GB mSATA SSD for caching. The huge 18.4-inch LCD is LED-backlit, with a 1,920 x 1,080 resolution and a 350-nit brightness. It's rather glossy, so you should avoid bright environments unless you enjoy seeing your own reflected face. It's also got a slot-loading DVD drive, which sadly isn't Blu-ray compatible, though that's an option by upgrading to a higher-end model.

Gaming on the Alienware is excellent and you can expect to handle just about any title with the settings on max. The keyboard is surprisingly plain – it's backlit, but otherwise sits in an expanse of unremarkable plastic. Typing is pleasant, though there's a small amount of flex if you hit the keys hard. The touchpad is accurate and we did appreciate the separate buttons, but the colour-changing backlight might not be to everyone's taste. Thanks to space for some large speakers, audio quality is quite good with enough bass to get by. That's lucky because under full load, the fan needed to keep those dual video cards from going up in flames is fairly noisy.

The Alienware has a largish 86Wh battery, but thanks to those power-hungry GPUs it's a struggle to reach even 2 hours of battery life when you're doing anything demanding.

If you just want to browse the net for as long as possible, you can switch to the Intel integrated GPU, but doing so requires a reboot. Despite the physically large chassis you don't get any more than the usual connectivity options: four USB ports, Gigabit LAN, HDMI, mini DisplayPort, 3.5mm audio I/O and a lock port. As you'd expect, there's also 802.11n Wi-Fi, Bluetooth 4.0 as well as an HD webcam and stereo microphones.

We often praise the Alienware laptops for their ability to be totally customised online; however, the 18 isn't quite as flexible as we'd like. While there are four different models for sale, you can't take a lower-end model and upgrade the CPU, HDD or GPU. The upgrade page also has a slightly nonsensical ad suggesting you can speed up performance by upgrading your RAM, but then limits you to 16GB with no upgrades possible.

At a desk-crushing 5.85kg for the laptop itself and another 1.7kg for the huge power brick, the Alienware is probably best moved with a heavy-lift helicopter. It's not exactly what we'd call svelte either – it's 436mm wide, 322.5mm deep and at 54.7mm it's also considerably very thick. Of course, these dimensions are put to good use, housing high-end hardware and a huge screen, but unless you're a 9ft tall giant, the Alienware isn't going to be particularly portable.

It's not a great bang-for-buck option either – it targets gamers who are prepared to pay for high-end hardware, not to mention the prestigious Alienware brand name and style. Still, if you're after a monster 18-inch gaming laptop that stands out from the crowd, this one is a genuine monster.



FATIGUE-REDUCING
KEYBOARD

COMPACT 89WH
BATTERY

REAR VENTED COOLING



7
10

ASUS G750JX

Cutting-edge features in an angular package.

www.asus.com.au @

\$2,300 \$

Thunderbolt support, ✓
Nvidia 3D Vision
support, great
keyboard.

Heavy, large. ✗

Supposedly inspired by the F-22 Raptor fighter jet, the ASUS G750JX has an aggressive style that really stands out from the competition. No slacker in the CPU department, the wedge-shaped shell hides an Intel Core i7-4700HQ CPU that boosts up to 3.4GHz from a 2.4GHz base. The GPU is up to par as well – an Nvidia GTX770M with 3GB of RAM.

It's got 16GB of DDR3 RAM installed, though you can go for the totally overkill upgrade and get 32GB. Our test unit came with dual 750GB 5,400rpm hard drives, but on the street you'll actually find this one with a combo 1TB 5,400rpm hard drive and a 256GB SSD. The latter's a much better choice in our book, as it'll increase OS responsiveness and cut down game load times, too. You also get a Blu-ray drive, which is great for watching movies and general future-proofing.

Like most of these gaming laptops, the G750JX runs the 64-bit version of Windows 8 – here it's the slightly more well-featured Pro edition. The LED-backlit display has a Full HD 1,920 x 1,080 resolution and wide 140° viewing angles. Colours are clear and vibrant without being over the top and light bleed was non-existent on our test model. The screen has a matte finish and provides excellent reflection-free viewing in all conditions. It also supports the 120Hz refresh rates needed for Nvidia 3D Vision gaming, but no glasses are included. It does support LightBoost, so your 3D gaming should be as vibrant as it is in 2D.

The ASUS sports a sizeable derrière, used to house a chunky cooling system. This is designed to stop overheating, as well as keep the noise and temperature down when gaming. Compared to laptops that vent heat out the side, the G750JX does a great job of keeping you isolated from

the hot bits; however, make sure you don't have the back end pushed up against junk on a desk or wall. At full blast the fans are audible, but we wouldn't quite describe them as loud.

The speakers are backed up by a subwoofer and provide very useable sound at low to medium volumes, though some distortion is noticeable if you crank it right up. The ASUS includes SonicMaster technology that helps boost sound through headphones and while it does make it feel a little meatier, the effect isn't huge.

The ASUS's keyboard is part of the metal top of the laptop and is among the most solid we've used – no matter how hard you bang away, it stays put. Rather than sitting flat on the laptop, the keyboard has a built-in angle that ASUS claims reduces fatigue; while we wouldn't go that far, it is very comfortable to use. It's also fully backlit and includes cleverly positioned arrow keys and a separate numpad. We found the touchpad large and responsive, while the chunky separate buttons are easy to press.

The G750JX has the usual array of ports: four USB 3.0, Gigabit Ethernet, VGA, HDMI, 3.5mm audio I/O plus an SD card reader. For those who want super-fast storage or dock options, it even has a single Thunderbolt port. You also get a Kensington lock port, 802.11n Wi-Fi, Bluetooth 4.0 and an HD webcam. With a tiny yet powerful 89Wh battery, the ASUS impressed us with over 3 hours of use. The G750JX weighs a rather hefty 4.8kg (though the 180W power brick is slimmer than most), so don't expect to drop it into a shoulder bag or use it on the train.

Available from as little as \$2,300 online, we think this one's certainly a solid buy.



i ONKYO SPEAKERS
SOUND BLASTER CINEMA
AUDIO
IPS SCREEN

8 10 **Clevo W586**

Plenty of bang for your buck.

www.bestdeal4u.com.au @

\$1,765 \$

Affordable, ✓
upgradable, portable.

No backlit keyboard, ✗
no Blu-ray, lacking bass.

You might not have heard of laptop brand Clevo before – we wouldn't hold it against you – but you may have actually seen its products. Clevo's a manufacturer whose laptops are often rebranded under other names; in this case, it's being imported, configured and sold by Aussie retailer Best Deal 4U.

It features the very popular fourth-gen Intel quad-core i7-4700MQ processor running at 2.4GHz and boosting up to 3.6GHz. It also has 16GB of DDR3 RAM and a 128GB SSD. For gaming, the 2GB Nvidia GeForce GTX 765M is certainly no slouch, though it's at the lower end in terms of power. Still, it can handle any modern game, but you might need to dial back the detail for particularly intensive games to maintain consistently playable frame rates. The 15.6-inch LED-backlit display has a 1,920 x 1,080 resolution. Even better, it's IPS, so it gives the sort of colour accuracy to make this one potentially suitable for video or image editors, too. Some would call the W586 plain, but we like the simple, clean lines and while the chassis is plastic, it feels tough and solid. Our test unit came with 64-bit Windows 7, though Best Deal 4U also offers Windows 8 if you prefer that.

The keyboard is your standard island design and includes a full (if very slightly cramped) numpad. The buttons have a little wobble if hit off-centre, but generally there's very little flex and typing is a pleasant experience. The touchpad is smaller than we'd like (despite being about average for the laptop size) and we had no issues with accuracy, while the separate buttons require very little force to press. Unfortunately, there's no backlight on the keyboard or touchpad, though the next model up has them. The W586 is

light and small enough for use on public transport and even has a flight mode button.

At full blast this unit does get a little noisy, but the sound and heat are channelled out the back of the laptop. The Clevo features Onkyo speakers, but we think they're a little light on bass quality for constant use. On the plus side, it comes with a Sound Blaster Cinema sound card that can output high-definition sound via its S/PDIF digital output.

Like any good gaming laptop, the Clevo is upgradable – a Core i7-4800MQ will cost you \$189, 24GB of RAM \$175, Blu-ray for \$89 and a second HDD from as little as \$119. If you want to go all out, there's even a model available that runs dual GPUs and up to an eight-core CPU. File hoarders are advised to go with a second drive. If you don't use your optical drive very often, you can even switch it out for another HDD. The W586 has decent connectivity, thanks to four USB ports (only two are USB 3.0), eSATA, Gigabit LAN, HDMI and even a legacy VGA port for older projectors. You also get the usual 2MP webcam, microphone, Kensington lock slot, SD card reader and a fingerprint scanner.

At 3.5 hours, battery life is solid, though you can easily stretch that out over 4 hours if you get serious with power saving and are just surfing the net. The 15.6-inch Clevo almost feels like a small laptop at 374mm wide, 252mm deep and just 31.4mm thick. It also only weighs 2.7kg and has an average-size power brick.

Amazingly, the Clevo costs just \$1,765 which truly offers one of the best deals out there for the budget-conscious laptop gamer.



i SOUND BLASTER X-FI 3
IC DIAMOND PASTE
COLOURED KEYBOARD
BACKLIGHT

8/10 Horize P170SM

Top-notch hardware without breaking the bank.

www.horize.com @

\$2,397 \$

Cheap, very powerful, feature-packed. ✓

Heavy, no OS included, small storage. ✗

Here in Australia, Horize has a range of laptops, from cheap portable units to high-end gaming machines. In our Labs this month was the P170SM, which comes with an Intel Core i7-4700MQ that trundles along at 2.4GHz until you put it under pressure, where it will boost to 3.6GHz. You can also optionally upgrade the CPU all the way up to an i7-4930MX, which can hit 3.9GHz.

The laptop comes kitted out with the powerful Nvidia GeForce GTX780M, which includes 4GB of GDDR5 VRAM. It's also got 16GB of DDR3 RAM (upgradable to 32GB) and a 128GB Plector mSATA SSD. The 17-inch LED-backlit screen runs at 1,920 x 1,080, has a matte finish and a 70% NTSC colour spectrum that does a decent job at reproducing your games. If you want to upgrade for work, an extra \$199 grabs a premium screen with 90% colour gamut, albeit one that also has a glossy finish.

The tech gurus behind the P170SM have made sure the cooling system is top-notch, using dual heatpipes and a fan, as well as IC Diamond paste to ensure the best contact between the CPU/GPU and the cooling system. Under load we found the Horize does get fairly noisy as the cooling fans spin up, though the rear-mounted exhaust fans thankfully keep noise and any heat generated away from you while gaming. The laptop comes with a Blu-ray drive, but if you don't want movies on your laptop you can downgrade to a standard DVD burner to save a little cash. There's also no secondary drive included, so if you are a file junkie without external storage, an upgrade is probably in order. The optical drive bay can also handle an HDD, which combined with the main bays and mSATA, lets you install up to five drives.

Audio is provided by Onkyo speakers driven by a Sound Blaster X-Fi 3. Sound quality is acceptable and will get you out of trouble when on the go, but in our mind it lacked the bass for everyday use. On the plus side, the P170SM includes a digital audio output, so it's easy to connect to your surround sound system if you're not using a headset. Our P170SM came with Windows 8 Professional 64-bit, though this isn't included in the quoted price. You can also get Windows 7 or if you already have an OS, you can get it shipped sans operating system.

The Horize has four USB ports, though only two are USB 3.0 and one is shared with the eSATA port. You also get FireWire, Gigabit LAN, HDMI, DisplayPort, mini DVI, a card reader and 3.5mm audio I/O jacks. An HD webcam, inbuilt microphones, 802.11n Wi-Fi and Bluetooth round out the connectivity options. For the security conscious, there's also a Kensington lock slot.

The keyboard on the Horize has a good feel, but is a little bouncy. On the plus side, it's backlit with seven different colour options. The touchpad is a little small, though it registered our every movement and had a nice, solid separate shortcut bar. The P170SM ships with a 76.96Wh battery and it's fairly demanding of it – in testing, it didn't manage much over 2 hours for anything that put the GPU and CPU under more than very light load. At 3.9kg, the P170SM is tiring to lug around, but the 410mm wide, 270mm deep and 40mm thick frame feels slimmer than it is.

Our model costs \$2,397 at the tested spec level, with the basic-level laptop available from \$1,999. The P170SM is backed by a one-year warranty that can be upgraded to three years for a fee.



TOTALLY CUSTOMISABLE

HIGH-END GPU AND CPU

SOUND BLASTER AUDIO

7
10

Origin EON15-S

Plenty of power in a petite package.

www.originpc.com.au @

\$3,899 \$

Powerful, small,
good battery life. ✓

Expensive, small
storage, no Blu-ray. ✗

Described as combining the slick high-tech design of a sports car with the sturdy construction of an SUV, the EON15-S looks good without going too over the top. Not skimping on processing power either, it has an Intel extreme Core i7-4930MX quad-core CPU that hums along at 3.0GHz and can boost up to 3.7GHz. Graphics grunt is provided by a very capable Nvidia GTX 780M with 4GB of RAM. It's also got 32GB of DDR3-1600 Corsair Vengeance RAM as well as dual 128GB Samsung 840 Pro SSDs running in RAID 0. The unit features a 15.6-inch Full HD 1,920 x 1,080 LCD with LED backlight and anti-reflective matte finish. Touted as a grade-A panel, it also comes with a 45-day no dead pixel guarantee.

While those dual SSDs give blazingly fast access speeds (topping out the laptops tested, with 318.98MB/s transfer speeds), it does mean this one's a little light on overall storage space. If you have a lot of files and are prepared to sacrifice a little speed, a large standard HDD instead of one of the SSDs would be a better option. In our test model only a DVD drive was installed, though you can upgrade it to a Blu-ray reader or burner if desired.

You can get the Origin in black, red or silver and the recess and logo cut-out in the lid add just enough flair to keep it from being utterly boring. The chassis is all plastic, but feels reasonably solid and includes some soft-touch panels. It has a Sound Blaster X-Fi 3 for superior audio quality, which includes 5.1 surround sound output via 3.5mm headphone jacks. The actual speakers are loud and fairly clear, and have plenty of bass, thanks to a subwoofer underneath.

The EON15-S comes with Windows 8 Pro 64-bit, but if

you'd prefer Windows 7, Origin will happily install that instead. For such a powerful laptop, we were quite impressed that this laptop managed over 2.5 hours from the 76.96Wh battery. Testing Origin's claims that with everything set to power-saving modes (and no gaming, obviously) you can eke out 6 hours, we managed just under at 5:54hr.

The EON15-S comes packed with connectivity: three USB 3.0 ports, one USB 2.0, an SD card reader, Gigabit LAN, eSATA, HDMI, DisplayPort, audio I/O, mini DisplayPort and a blast from the past with FireWire. You also get a webcam, microphone, fingerprint reader and Kensington lock slot. Wireless is provided by an Intel PRO Wireless AC 7260 card, which means 802.11ac support (up to 867Mbps) plus dual-mode Bluetooth 4.0. The unit weighs in at 3kg, which is dense for the size, but still more portable than most here. It's not exactly slim at 42mm thick, not to mention 260mm deep and 376mm wide, yet it will still slip into a standard shoulder bag or backpack.

While our Origin laptop came packed to the gills with high-end hardware, you can customise your own cheaper (or more expensive) model. As tested it costs \$3,899, with lower-spec versions of this model starting from \$2,000. If you're an AMD fan, you can even put in a 4GB Radeon HD 8970M.

The EON15-S comes with a one-year warranty with free lifetime labour and 24/7 phone support, though you can up that to three years if desired. While expensive, it packs a lot of power into a tiny chassis. Combine that with the flexibility to customise to the exact specs you want and this makes for a great gaming laptop.



i 2TB STORAGE
HD WEBCAM
MSATA SUPPORT

6 **10** **Toshiba Qosmio X70-A014** A solid yet stylish full-size gaming machine.

www.mytoshiba.com.au @

\$2,700 \$

Large screen, powerful GPU, Blu-ray drive. ✓

Poor trackpad buttons, low battery life, preinstalled junk software. ✗

The Qosmio range has been around for almost 10 years, offering high-performance desktop replacement-style laptops. This new X70 is powered by an Intel Core i7-4700MQ CPU that hums along at 2.4GHz and can boost up to 3.4GHz. There's 16GB of DDR3-1600 RAM, which is more than enough for gaming, though if you want to go for overkill you can upgrade to 32GB. Graphics grunt is provided by an Nvidia GeForce GTX 770M, with 3GB of RAM.

The 17.3-inch widescreen monitor sports a Full HD 1,920 x 1,080 resolution and is LED-backlit. Colour reproduction is good, but it suffers a little at wide horizontal angles and our test unit showed very minor light bleed on the sides. The glossy screen also has a tendency to reflect a lot of light. In our test model, storage is provided by dual 5,400rpm 1TB HDDs plus an 8GB cache SSD – you can also add in a separate 256GB mSATA SSD if you want to push for the fastest speeds. Despite being described by Toshiba as an uber-cool groovy design, the X70 is pleasantly understated. The brushed metal case is highlighted in red, but avoids being too garish.

As expected from the powerful CPU and GPU, gaming on the Qosmio is excellent and you can expect solid frames rates at full detail on all but the most demanding games. Considering the fact that it's aimed at gamers, it comes with a depressingly large amount of preinstalled trialware that needs to be removed, such as a resource-hogging Norton trial. The X70 includes a Blu-ray drive, which coupled with the large screen helps it double as a portable entertainment centre. If you have a compatible TV, you can play 3D movies via HDMI. Despite four Harman Kardon speakers, we'd rate the audio quality as just OK – they're fine for day-to-day use,

but have a tinny note and lack bass when pushed.

The backlit keyboard is excellent, however, with a very solid feel from the island-style keys as well as a full-size numpad. The touchpad is large with good sensitivity, though the integrated buttons are best avoided, requiring an annoyingly firm and deep push to activate. The X70 has a fairly small 47Wh battery, which means it conks out after less than 1.5 hours of normal use. You can switch to the Intel HD 4600 integrated graphics to improve battery life if the main GPU isn't needed.

While not exactly bristling with ports, the Toshiba has the essential connectivity options: a Gigabit LAN port, VGA, 3.5mm headphone and microphone jacks, HDMI, SD card slot and four USB 3.0 connectors. You also get an HD webcam, built-in stereo microphones, Kensington security lock port as well as the obligatory 802.11n Wi-Fi. For those who like to use wireless mice, the X70 supports version 4.0 of Bluetooth for a super-fast connection. Rather than a standard DC plug, the X70 uses a chunky four-pin power connector; while this is robust, it can be a pain as it only plugs in one way. Not surprisingly, the power brick is huge and can pump out a meaty 180W.

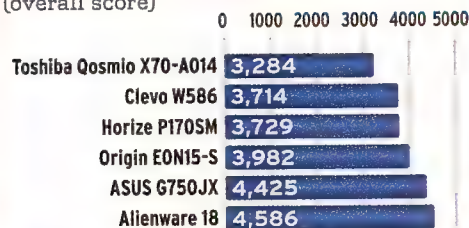
You'll need to invest in an oversized carry bag if you plan to take the X70 on the road with you, as it's 418mm wide, 272.5mm deep and a rather chunky 43.5mm thick. That said, at 3.5kg it's actually fairly light for its size and is (comparatively) quite portable.

With a \$2,700 street price the X70 isn't exactly the cheapest gaming laptop available, but it has powerful hardware and an understated style that make it a worthy purchase... despite a few niggling downsides. **8/10**

GENERAL PERFORMANCE

PCMARK 8 - HOME

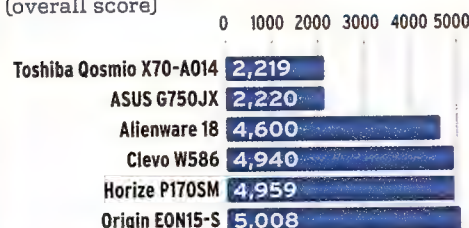
(overall score)



GENERAL PERFORMANCE

PCMARK 8 - STORAGE

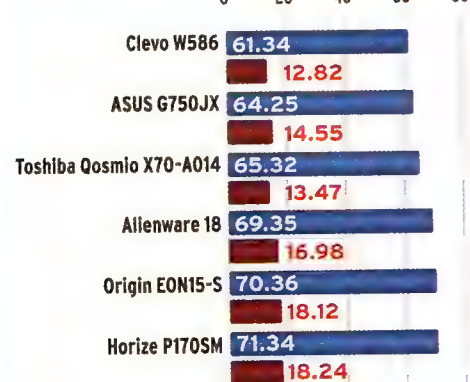
(overall score)



GENERAL PERFORMANCE

PCMARK 8 - STORAGE

(average transfer speed MB/s)

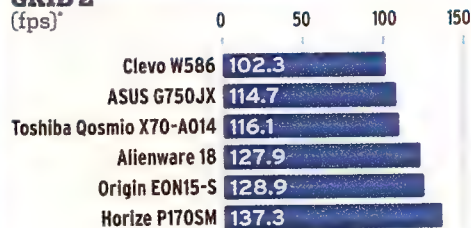
VIDEO ENCODING PERFORMANCE
X264 BENCHMARK 5.01

Pass 1 (average fps)
 Pass 2 (average fps)

GAMING PERFORMANCE

GRID 2

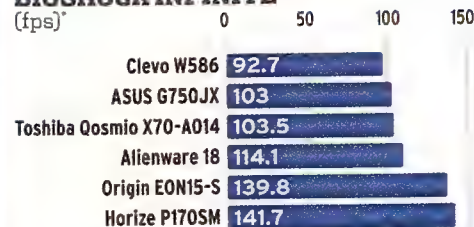
(fps)*



GAMING PERFORMANCE

BIOSHOCK INFINITE

(fps)*



GAMING PERFORMANCE

COMPANY OF HEROES

(fps)*

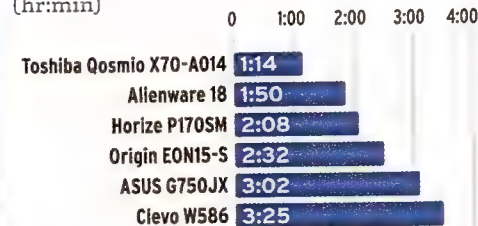


* All games tested at 1080p with Normal/Medium detail settings.

BATTERY LIFE

PCMARK 8 - HOME

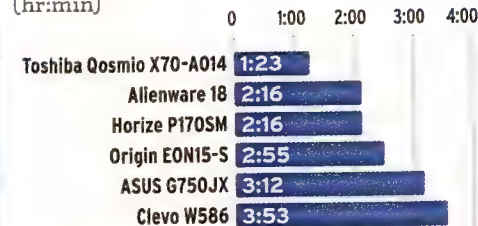
(hr:min)



BATTERY LIFE

PCMARK 8 - WORK

(hr:min)





SOLID-STATE SUPERSTARS

No more excuses. High-capacity SSDs are now truly affordable.
Jeremy Laird surveys the latest developments in solid-state storage.

FASTER, BIGGER, CHEAPER: WHAT'S NEXT FOR SSDS?

Now we know big SSDs are getting cheaper, what else can we expect to see in the near future? As we discussed a couple of months ago (see *APC* July, page 32), PCI Express (PCIe) is going to help lift the lid on peak sequential performance and Apple's 2013 MacBook Air offers around 750MB/s for both reads and writes, but that's just the beginning.

ADATA has announced the SX2000 and the numbers it delivers are truly spectacular. For starters, it weighs in at an enormous 1.6TB. Then there are read and write speeds of 1.8GB/s. And here's the clincher: ADATA is claiming it's also good for 200,000 IOPS, so random performance should be mighty impressive, too. For the record, that's made possible by the new SFF-8639 interface, which is essentially a four-lane PCIe solution. It won't be cheap, though; we expect pricing somewhere north of \$2,000. It's really an enterprise-class drive, but it does hint at the future of drives for desktop PCs. Another interesting development is Thunderbolt – Intel's super-fast general-purpose connection. The second generation of Thunderbolt is good for 20Gbps, which puts it in similar territory to a four-lane PCIe interface. Intel has recently been showing off a 128GB Thunderbolt 2.0 thumb drive prototype. The idea of a thumb drive that outperforms today's SSDs is intriguing. As for the development of the memory chips themselves, things keep getting smaller. Toshiba has just announced its latest 64GB NAND chips, claimed to be the smallest yet. And as these chips get smaller, they should hopefully get cheaper, too.

Even better, Toshiba says it's tooling up to produce triple-level cell (TLC) memory on the same process later this year. So far, only Samsung has sold TLC memory into the mainstream. Toshiba says its TLC chips are initially targeted at smartphones and tablets, where memory density is super critical. But the new chips are also destined for PC SSDs. 500GB drives for under \$300 next year? That looks very likely indeed.

Size matters. And when it comes to SSDs, size costs, too. At least, it did. Back in 2008, Intel launched its first SSD aimed at mere punters rather than enterprise customers. You forked out \$600 and you received 80GB in return. Yeah, just 80GB. OK, conventional hard disks were also pricier per gigabyte in 2008, but it was still roughly a case of swapping the 'GB' and '\$' symbols around. Less than \$130 bought you more than 400GB of spinning magnetic platters even then.

So size has definitely been a source of insecurity for SSDs. Sure, you can combine a tiny SSD with a fat old magnetic drive and theoretically have the best of both worlds: speed and performance. Even the tiniest SSD will soak up a Windows installation. Simply chuck the rest in the big old data bin that is a cheap conventional hard disk. The problem with that theory is applications. They also like storage performance – especially games – and a decent games library needs some fairly serious space. For us, that means an absolute minimum of 240GB and ideally closer to the 500GB mark.

The good news is that's now becoming much more realistic. SSDs in the 500GB region can now be had for under \$500. OK, you'll have to pay more to get the latest and fastest models, but we're no longer talking about silly money for truly usable solid-state storage. If the size problem is nearly solved, there's plenty more keeping solid-state storage interesting. While CPU and GPU development seems to be tailing off, SSDs are still a fairly early-phase technology. Part of their development path involves things like controller chipsets and the flash memory chips themselves. It's probably going to have more impact on SSD prices and performance than it will on processors or graphics chips in the near future.

In the meantime, however, big and beautiful SSDs have never been more affordable. If you've been holding out, now's a great time to seriously think about diving in.

i SATA 6GBPS INTERFACE
25NM SYNCHRONOUS
MLC MEMORY
SANDFORCE SF-2281
CONTROLLER

7
10
\$645



ADATA XPG SX900 512GB

Bigger than the average SandForce-based drive.

- @ www.adatagroup.com
- ✓ More extra space than usual.
- ✗ Average random access performance.

We've seen the future and its name is ADATA. Except it's not this drive and it won't be called ADATA. What you talkin' about, Willis? Apologies, allow us to explain.

Willis was a character from the popular '80s American television sitcom, *Diff'rent Strokes*. His brother Arnold... oh, hang on, it's the ADATA bit you're confused about. Well, try this. We've been wondering when the next big thing in SSDs is going to arrive and an early indication is the ADATA SX2000. Yup, SX2000, not SX900. The former isn't out yet. It's based on a PCIe interface rather than SATA and sports SandForce's exotic new controller chipset, codenamed Griffin, but what we actually have our hands on is the XPG SX900.

The XPG SX900 is based on older SandForce SF2281 tech and is thus a known quantity. Indeed, we've read this riot act many times: initially impressive sequential numbers that fall away when you bung incompressible data into the equation, less-than-stellar random access performance, yada yada.

But don't SandForce drives usually weigh in at 480GB rather than 512GB? Yup. The SandForce controller normally requires around 15% spare capacity. Flash memory cells wear out with use, so having some to spare extends the drive's functional life. In short, ADATA has disabled one of the wear-compensation technologies, unlocking nearly 30GB of extra space. What impact that has on longevity, well, that's tough to tell.

i SATA III 6GBPS
INTERFACE
24NM TOGGLE MLC
MEMORY
LAMD LM87800
CONTROLLER

8
10
\$270



Corsair Neutron GTX 240GB

A fine drive, but doesn't stand out from the crowd.

- @ www.corsair.com
- ✓ 24nm Toggle chips, impressive sequential and random access performance.
- ✗ Low memory space.

Send that old SandForce controller away and bring me the lovely new LAMD controller. So said the head of Corsair. Corsair has tired of using SandForce for its highest-performing drives. It had no choice really, if it wanted to keep somewhere near the cutting edge, because the SandForce SF-2281 is looking rather tired.

In its place comes the LAMD LM87800. The LAMD bit stands for Link A Media Device, which is a bit of a mouthful. Anyway, here we're talking dual ARM cores, eight memory channels and that's about all we know. Unlike CPUs and graphics chips, it's not usually common to reveal too much about SSD controller technology.

As for the rest of the drive, this Corsair is the best of the best. Where the plain old Neutron shares the LAMD controller and pairs it with 25nm synchronous ONFI memory, the Neutron GTX gets Toshiba's finest 24nm Toggle chips. Whether it's sequential performance with compressible or incompressible data, random access performance or real-world apps, the Neutron GTX is absolutely in the mix.

What this drive isn't is terribly cheap or terribly big. We're not talking about the comparison between 480GB or 512GB drives. We're talking about 240GB versus 256GB. In other words, the Neutron GTX doesn't blow the competition away by any obvious metric. It's not clearly faster, larger or cheaper.

i SATA 6GBPS INTERFACE
20NM SYNCHRONOUS
MLC MEMORY
MARVELL 9187
CONTROLLER

9
10



\$475



Crucial M500 480GB

Not the fastest, but more affordable than most.

@ www.crucial.com

✓ Price, impressive Marvell 9187 chipset, strong performance where it counts.

✗ Other SSDs have faster peak sequential performance.

A 480GB SSD with one of the best controller chipsets in the world? Made by one of the biggest brands in computer memory? For under \$500? Don't bother with supper and a movie, we've slipped into something more comfortable already.

But hang on, maybe we should play a little harder to get. After all, SSDs are perhaps the most mercurial of all PC components. The specs and claimed performance numbers never tell the full story and that's just for the initial experience. The long-term reliability is even trickier.

So, let's recap. The M500 is a 480GB drive from our old friends at Crucial, which is the consumer brand name for Micron, one of the biggest memory chip makers on the planet. Indeed, Micron and Intel have teamed up to make memory chips together. It's a major player.

On the chipset side, the Marvell 9187 is one of the best-regarded controllers out there. Then there's the memory, which is Intel and Micron's latest 20nm synchronous memory. So what about the performance? Strong where it matters is the bottom line. There are SSDs with 5% faster peak sequential performance, but it trades blows with the best when it comes to random access performance.

The overall point here is that the performance of the very best drives has bunched up of late, which is where the M500's killer advantage punches through: its price. It's very aggressive and it can't help but make you wonder why you'd pay more. We've wondered about that and we can't come up with an answer. Money being no object, the likes of Samsung's 840 Pro would be very tempting, but money is an object and we very much doubt that we'd be able to feel the difference subjectively.

i SATA 6GBPS INTERFACE
25NM SYNCHRONOUS
MLC MEMORY
SANDFORCE SF-2281
CONTROLLER

7
10

\$589



Intel 520 480GB

Intel reliability plus SandForce speed. A killer combo?

@ www.intel.com.au

✓ Intel reliability.

✗ Doesn't work with incompressible data, unimpressive random access performance.

Back when the very notion of an SSD was sexy and new, Intel's opening gambit, the X25-M, cast all asunder. It was the best SSD money could buy, albeit for a metric tonne of money.

Fast forward a mere 4.5 years and everything has changed. In that time, we learned that the performance of Intel's early SSDs fell off a cliff with sustained use. Then we learned that the TRIM command helped prevent the build-up that turned those early SSDs into stuttering wrecks. We also learned that making a great SSD controller is no mean feat. In fact, it's so hard Intel threw in the towel, at least temporarily, and shoehorned the SandForce SF-2281 into the 520 Series SSD.

Of course, this is no chintzy lash-up of an SSD. It's been subjected to Intel's gruesome validation routines, so what we were presented with at the 520's launch was the best of both worlds: scorching performance courtesy of a SandForce controller, combined with Intel reliability.

But that was over a year ago and the SandForce SF-2281 now looks rather ordinary. The problem is SandForce's data compression tech. Funnily enough, it doesn't work with incompressible data, and quite a lot of data is incompressible as far as an SSD controller is concerned.

So, just like the Transcend SSD720, initially impressive sequential read and write performance drops off when you inject incompressible data into the mix. Making matters worse, the SandForce controller has fallen behind when it comes to IOPS and therefore random access performance. All of which means the performance part of the argument is undermined and you're left largely with the reliability angle. Which is a little less, er, arousing.

i SATA 6GBPS INTERFACE
20NM SYNCHRONOUS
MLC MEMORY
INDILINX BAREFOOT 3
CONTROLLER



8
10

\$289



OCZ Vertex 450 256GB

Kudos to OCZ for cooking up its own controller.

@ www.ocz.com

✓ Competitive sequential read and write speeds, good random write performance.

✗ Random performance doesn't fare so well.

Samsung and its 840 Pro are the unassailable overlords of SSDdom, so say hello to the Winston Smith of solid-state storage. The point is that the OCZ Vertex 450 is a beacon of hope and courage in the face of almost totalitarian power. In financial terms, OCZ is but a rounding error on Samsung's balance sheet, so we doff our hats to it for bringing this competitive SSD to market.

This is no simple rebadge job, nor does OCZ half-inch components from other companies' shelves. Well, it does have to take memory chips from the open market. For the record, OCZ uses Micron's 20nm MLC NAND memory.

No, the impressive bit is that OCZ makes its own controller chipset. At least, that's the case as far as we can tell. OCZ has previously made claims in this area that didn't quite hold up, but the latest Indilinx Barefoot 3 controller appears to be the real, proprietary deal.

Going by our benchmarks, we'd say that's true because the 450 carves out something of a unique niche. A lot of our drives are very closely matched, but there are enough differences to make out a pattern. The 450 is right up there in almost every metric. Sequential reads and writes are close enough to the competition that it hardly matters, and so are our application tests, though you can say that of every drive.

Random write performance is as good as it gets, too. The chink in the armour is random reads. Is 19MB/s versus, say, 26MB/s a disaster? Not really, but since random performance is the metric that most worries us, it's notable. It's also a shame we couldn't get hold of the 512GB version to see how it fares against the Samsung.

i SATA 6GBPS INTERFACE
21NM TGGLE MLC
MEMORY
SAMSUNG MDX
CONTROLLER



8
10

\$519



Samsung 840 Pro 512GB

Samsung tears all asunder. Resistance is futile.

@ www.samsung.com/au

✓ As speedy as SSDs come, reasonably priced.

✗ OCZ Vertex 450 beats it when it comes to 4K random writes.

Right, we want to make one thing extremely clear from the get go: we absolutely welcome our new Samsung overlords. Whether it's components like memory chips, processors and LCD panels or retail clobber like phones and TVs, Samsung is assimilating everything.

In that context, two things are immediately apparent. The first is that you'd better not be in the bad books when the People's Republic of Samsung comes into force, as seems to be inevitable. The second is that it should come as no surprise that Samsung makes damn fine SSDs.

For starters, Samsung makes its own flash memory. It's the snazzy 21nm Toggle NAND sort, so it's basically about as speedy as it currently comes. Samsung also makes its own controller chipsets and as far as anyone can tell, those are about as good as it gets, too. For proof, look no further than our benchmark results. Fastest sequential reads and writes for both compressible and incompressible data? That'll be the Samsung 840 Pro. It serves up the fastest 4K random read access, too.

But wait. The OCZ Vertex 450, among others, beats it when it comes to 4K random writes. What devilry is this? No doubt, OCZ will soon be obliterated in some kind of secret service-style whack job. It cannot be allowed. In all seriousness, though, this is a very fine drive and we'd say that even if we weren't terrified of Samsung. Not only is it one of the quickest around, it comes with the peace of mind that you're buying from a big outfit that's very unlikely to disappear.

If you do have a problem, the odds of being able to cash in your warranty are high. That it's also pretty reasonably priced for a premium drive just adds to the appeal.

i SATA 6GBPS
INTERFACE
19NM TOGGLE MLC
MEMORY
MARVELL 9187
CONTROLLER



**8
10**

\$259



SanDisk Extreme II 240GB

The cream of the 250GB-ish drives.

@ www.sandisk.com.au

✓ Strong all-round performance.

✗ None really come to mind.

Pinch a controller chipset off the shelf, bung some memory chips onto a PCB and you're in the SSD business. That's what it felt like for a while, what with everyone jumping on the SandForce bandwagon and the fact that SandForce controllers come with ready-cooked firmware and few options to stand out.

At least, that was true until Intel came along with its own take on SandForce SSDs, but even then, the performance profile was all very familiar. We suspect Intel's tweaks to the SandForce firmware focused on reliability. These days, of course, the customer chipset of choice is none other than the Marvell 9187.

The difference is you have to bring your own firmware to the party – Marvell doesn't supply one. That mainly means two things. For starters, the barriers to entry are that bit higher because you have to have enough nerds on the payroll to develop a full-on firmware. Secondly, it means there's a little more variation between SSDs based on ostensibly the same controller. In the old days you saw SandForce on the spec sheet and you knew exactly what to expect. That's not the case with the Marvell controller.

What sort of a fist has SanDisk made of the 9187 chipset in this latest Extreme II SSD then? Pretty stellar, actually. Direct comparisons with the other Marvell 9187 drive in this test, the Crucial M500, are tricky due to the gap in capacity – the number of memory chips per channel does influence performance – but there's little doubt SanDisk has done a great job. There really are no weak points in the performance package. What's more, SanDisk serves up a meaty five-year warranty as standard, which should cover the vast majority of users very comfortably indeed.

i SATA 6GBPS
INTERFACE
19NM TOGGLE MLC
MEMORY
LAMD LM87800
CONTROLLER

**8
10**

\$529



Seagate 600 480GB

A strong overall package, but pricey.

@ www.seagate.com

✓ A good overall performing SSD.

✗ Beaten marginally by the Corsair Neutron GTX by most metrics.

Scary thing, solid-state storage. At least, it is if your bread has been historically buttered by traditional magnetic hard drives, as it has for Seagate. Yup, SSDs are a pretty epic problem on every level for old school hard drive makers. Their technical expertise in designing and engineering magnetic platters counts for nought. Ditto their investment in manufacturing facilities.

In fact, SSDs may as well be graphics cards for all the tech they share with magnetic drives, which is to say almost none. So we don't entirely blame Seagate for crashing the SSD party so late with the 600 series – its first drive aimed at consumers.

Seagate would probably argue that it's only recently that punters have been buying SSDs in numbers worth worrying about. It's been making SSDs for servers for a while, so it's not entering the market short on experience. The spec of the new 600 underlines the challenges the likes of Seagate face making the transition. Even with Seagate's might and money, it has thought better of using an in-house controller chipset and gone with the LAMD LM87800, as seen in the Corsair Neutron GTX.

Indeed, it's handy to have the Corsair because it gives us a yardstick for comparing how the LAMD controller performs at different capacities. Both drives use Toshiba Toggle NAND, so that's helpful in providing a level playing field, too. The general point here is that there's typically a sweet spot regarding the number of flash chips you want to attach to each memory channel. According to our testing, it's probably 240GB rather than 480GB.

The gap isn't huge, but the Corsair is slightly quicker by most metrics, even if Seagate using its own firmware does confuse the situation.

i SATA 6GBPS INTERFACE
19NM TOGGLE MLC
MEMORY
CUSTOMISED MARVELL
CONTROLLER

\$210

**8
10**



Toshiba Q Series 256GB

An excellent all-round performer.

- @ www.mytoshiba.com.au
- ✓ Mostly impressive performance, particularly sequential read performance.
- ✗ Less than stellar random read and write results, probably attributed to the customised Marvell controller.

Curse Henry F. Phillips and his self-centring screws. Sure, the simple Phillips-head screw was a key enabler of mass production and thus the industrial revolution, but super-small Phillips-head screws can be awfully fiddly. On this occasion, a quartet of the blighters got in the way of us cracking open the shiny new Toshiba Q Series 256GB. It's the first we've seen of the thing and unfortunately, Toshiba isn't hugely forthcoming with some of the key specs.

A teeny screwdriver later and we're in. What's inside is interesting. Inevitably Toshiba is using its own 19nm Toggle MLC NAND chips, but the actual controller silicon is from Marvell, but with a Toshiba twist.

All of which bodes well for performance. After all, what really matters is the drive's performance in the real world, not its quoted, hypothetical speed. For the most part, the new Q Series is very impressive.

Sequential read performance with incompressible data of 514MB/s is very near the top of the pile and writes of 469MB/s are also far from shabby. Slightly less stellar are the 18MB/s and 45MB/s random read and write results, respectively. That's probably down to the Tosh twist to the Marvell controller. It normally comes with a DRAM cache, but that's missing here. It doesn't affect the straight performance, but the random speed suffers. However, the Q Series is very marginally the fastest drive in both of our real-world application tests.

We'd usually give an SSD the nod for that alone, but the tight grouping of all the drives in the benchmarks makes it clear that SSD performance has now gotten the better of those parts of our test suite. Something other than drive performance is putting a cap on the real-world tests.

i SATA 6GBPS INTERFACE
24NM TOGGLE MLC
MEMORY
SANDFORCE SF-2281
CONTROLLER

\$540

**6
10**



Transcend SSD720 512GB

The SandForce SF-2281 isn't the world-beater it used to be.

- @ au.transcend-info.com
- ✓ Impressive peak performance with compressible data.
- ✗ Sequential write performance drops for incompressible data, mediocre 4K random performance.

Transcend has been in the memory game for longer than most and was one of the very first outfits to flog SSDs aimed at punters with PCs rather than just to big businesses. Indeed, dig a little deeper and you'll find that the gubbins inside the Transcend SSD720 series is pretty familiar. Perhaps a little too familiar. The controller chipset is none other than ye olde SandForce SF-2281.

Of course, you might think it's a bit rich to talk about the SF-2281 as though it's some desiccated spinster at death's door. It's wasn't all that long ago we were hailing it as the greatest advance in solid-state tech since some guy in a lab coat sacrificed his personal hygiene to develop a better alternative to the vacuum tube.

The problem is, progress is relentless, as is our understanding of what makes for a good SSD. We now know that the SF-2281 has certain shortcomings. Notably, it delivers its impressive peak performance numbers beyond the 500MB/s mark courtesy of data compression. Which is clever, except that much of the data you shunt around (like images, music and video) isn't compressible. That explains why the Transcend SSD720 drops from 456MB/s to 259MB/s when you compare compressible and incompressible sequential write performance.

That said, even 259MB/s is probably good enough in subjective computing terms. Instead, it's the mediocre 4K random performance that really puts us off this drive. It's a metric where we'd like to have much more performance than even the fastest drives can manage, so the fact that the SSD720 is well off the pace, especially for 4K random writes, is approaching deal-breaker territory.

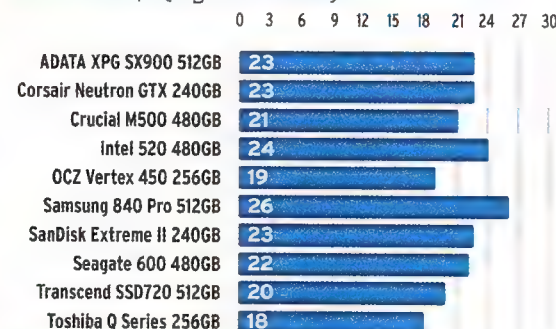
SOLID-STATE DRIVES

Product	Price	Web	Capacity	Memory type	Interface	Controller
ADATA XPG SX900 512GB	\$645	www.adatagroup.com	512GB	25nm Synchronous MLC	SATA 6Gbps	SandForce SF-2281
Corsair Neutron GTX 240GB	\$270	www.corsair.com	240GB	24nm Toggle MLC	SATA 6Gbps	LAMD LM87800
Crucial M500 480GB	\$475	www.crucial.com	480GB	20nm Synchronous MLC	SATA 6Gbps	Marvell 9187
Intel 520 480GB	\$589	www.intel.com.au	480GB	25nm Synchronous MLC	SATA 6Gbps	SandForce SF-2281
OCZ Vertex 450 256GB	\$289	www.ocz.com	256GB	20nm Synchronous MLC	SATA 6Gbps	Indilinx Barefoot 3
Samsung 840 Pro 512GB	\$519	www.samsung.com/au	512GB	21nm Toggle MLC	SATA 6Gbps	Samsung MDX
SanDisk Extreme II 240GB	\$259	www.sandisk.com.au	240GB	19nm Toggle MLC	SATA 6Gbps	Marvell 9187
Seagate 600 480GB	\$529	www.seagate.com	480GB	19nm Toggle MLC	SATA 6Gbps	LAMD LM87800
Toshiba Q Series 256GB	\$210	www.mytoshiba.com.au	256GB	19nm Toggle MLC	SATA 6Gbps	Toshiba/Marvell
Transcend SSD720 512GB	\$540	au.transcend-info.com	512GB	24nm Toggle MLC	SATA 6Gbps	SandForce SF-2281

LABS BENCHMARK RESULTS

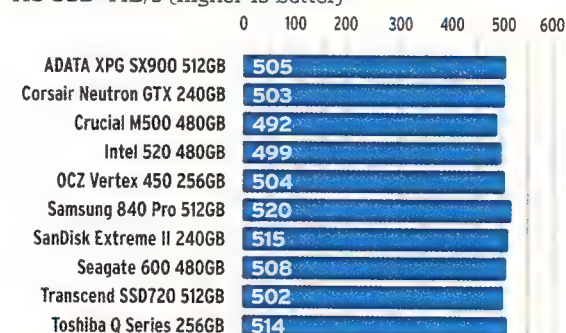
4K RANDOM READ PERFORMANCE (INCOMPRESSIBLE)

AS SSD: MB/s (higher is better)



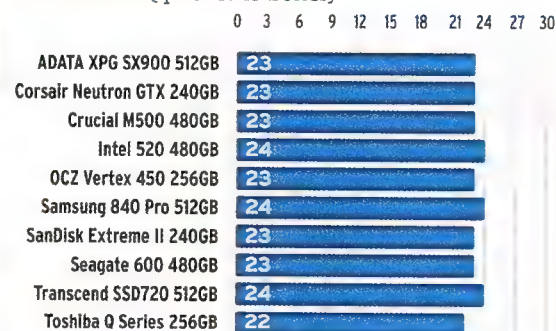
SEQUENTIAL READ PERFORMANCE (INCOMPRESSIBLE)

AS SSD: MB/s (higher is better)



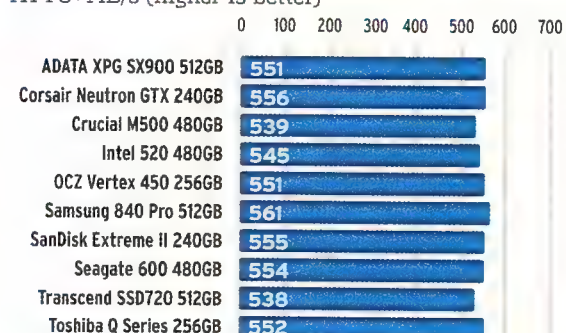
ZIP FILE DECOMPRESSION

ZIP: Seconds (quicker is better)



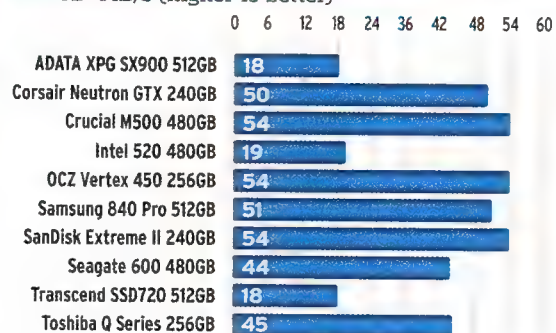
SEQUENTIAL READ PERFORMANCE (COMPRESSIBLE)

ATTO: MB/s (higher is better)



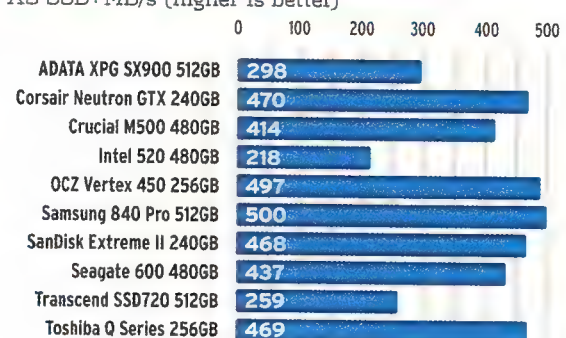
4K RANDOM WRITE PERFORMANCE (INCOMPRESSIBLE)

AS SSD: MB/s (higher is better)



SEQUENTIAL WRITE PERFORMANCE (INCOMPRESSIBLE)

AS SSD: MB/s (higher is better)



PCIe SSDs, such as OCZ's RevoDrive, squirt out massive sequential numbers, but are less impressive for random access.



The LAMD LM87800 as found in Corsair's Neutron GTX is a rare newcomer to the battlefield.

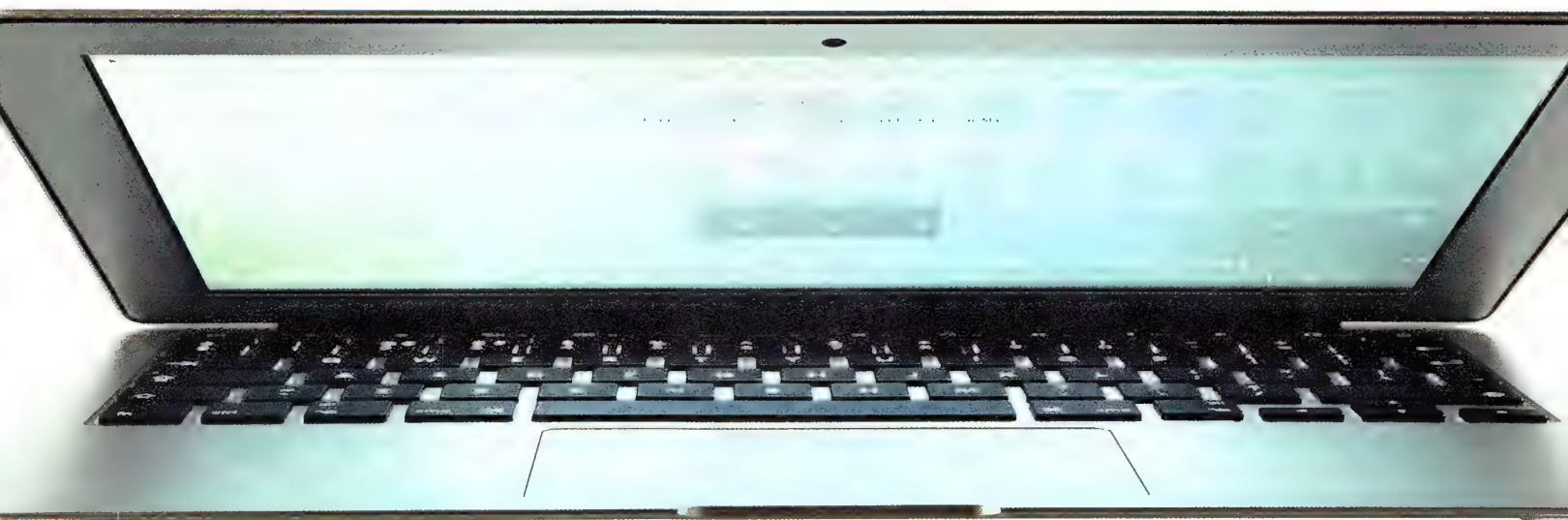
Quoted read	Quoted write	Peak IOPS	Warranty
540MB/s	465MB/s	55K	3 years
555MB/s	511MB/s	85K	5 years
500MB/s	400MB/s	80K	3 years
550MB/s	520MB/s	50K	3 years
540MB/s	530MB/s	90K	3 years
540MB/s	520MB/s	100K	5 years
550MB/s	520MB/s	83K	3 years
500MB/s	400MB/s	80K	3 years
550MB/s	500MB/s	90K	3 years
560MB/s	540MB/s	93K	3 years

HOW WE TESTED

We're approaching the end of an era. That applies both to this crop of SSDs and our testing. The result is a set of benchmark scores that, for the most part, are very tightly grouped.

Part of the problem is the SATA interface. All of these drives are, at least in part, restricted by the 6Gbps limitation of the current SATA interface. PCIe-derived drives are on the way, of course, so we have a rough idea of what the future looks like for interfaces. Part of it is generational. Only recently have random access and IOPS performance really been viewed as critical and that takes time to work through the development process. We expect the next year or two will see some major progress when it comes to random access. The final part is our testing. The simple fact is that these latest drives have caught up with our benchmarks. The file decompression and game installation tests are clearly limited, at least in part, by other parts of the platform.

We'll be looking very closely at introducing some new tests that really sort the best from the rest. In the meantime, this is one of the closest group tests in APC's history. There are no duds here, but once you take into account pricing and extras like the warranty, one or two drives certainly stand out.



The MacBook Air is an example of just what can be achieved with PCIe, even in an ultraportable form factor.

PCIe used to mean 16-lane slots in motherboards. Pretty soon it will be just as commonly used for connecting SSDs.



SEQUENTIAL WRITE PERFORMANCE (COMPRESSIBLE) ATTO: MB/s (higher is better)

0 100 200 300 400 500 600

ADATA XPG SX900 512GB	519
Corsair Neutron GTX 240GB	506
Crucial M500 480GB	432
Intel 520 480GB	475
OCZ Vertex 450 256GB	534
Samsung 840 Pro 512GB	535
SanDisk Extreme II 240GB	518
Seagate 600 480GB	473
Transcend SSD720 512GB	465
Toshiba Q Series 256GB	519

masterbuilder

BUILD YOUR PERFECT PC WITH TECH EXPERT DARREN YATES.

BUILD YOUR OWN APPLE MAC

It goes against the Apple licence agreement, but making your own Apple Mac computer has spawned a huge underground community. **Darren Yates** reveals the best hardware for the job.

When Apple announced back in 2005 that it was ditching PowerPC and heading for Intel to supply CPUs for its computers, hackers worldwide rejoiced at the thought of being able to finally build their own Macs. Since then, an underground 'Hackintosh' community has bloomed as users worldwide create working Mac OS X-powered computers on generic Intel hardware.

So what's involved and what do you need? First, you'll need a working Mac computer. While there are a number of illegal Mac OS X ISO images available on the web, the community increasingly frowns on these and the vast majority of efforts are devoted to using legitimately purchased copies of Mac OS X – either disc-based for the old Snow Leopard (10.6) release or purchases from the Apple Store for subsequent releases. To make these Apple Store-purchased versions workable, however, you need a Mac to create a bootable Mac OS X USB installer flash drive.

NEW ISN'T BEST

The other thing is, this is actually one time when buying the latest kit will likely work against you. Unlike Microsoft, which must cater for a world of different PC components, Apple only has to support its own hardware so the driver support is far more limited. That means the community has to do a bit of work getting each new generation of Intel hardware running with Mac OS X. That takes time and there's no guarantee every component will produce the perfect Mac OS X experience.

There are two key issues: the CPU and the motherboard. Since Apple uses Intel processors only, the community focuses its efforts on Intel hardware. The motherboard issue is more complicated. Generic Intel boards from Gigabyte, ASUS, MSI and others may use Intel chipsets, but they also use other third-party components for networking, sound and other features – components Apple may not support. You can't guarantee that every motherboard will work perfectly.

If you want to add a third factor, it'll be the graphics card. Apple switched from Nvidia to AMD from 2009 to 2011, so there are a number of Radeon cards that work, but a larger number of Nvidia cards that work. Again, not every graphics card is guaranteed to get along with Mac OS X – it comes down to whether Apple actually used the GPU in one of its Mac computers at some point.

COMPATIBILITY LIST

The community has created a compatibility list, which shows the success other users have had with specific motherboards, graphics cards and mostly what they did to get things working. For example, if you purchase a particular board

listed, you should be able to build the same experience other users of that board have had by doing what they did. The best of these lists is found at the OSx86 Project (tinyurl.com/d93dc). There are different listings for the last three major versions of Mac OS X, starting from 10.6 (Snow Leopard), so check those before you proceed.

INSTALLING MAC OS X

This is the complicated bit. When Apple used to release Mac OS X on DVD, you could bootstrap a Hackintosh, meaning you didn't need a Mac to begin with. Now that you can only buy the update through the Apple Store, you need a Mac to start the process. Why? You have to load the Mac OS X installer onto a USB flash drive and that needs a Mac. That's where tonymacx86 has greatly simplified the process with tools he's called UniBeast (to help build the Mac OS X USB flash drive installer) and MultiBeast (to install the bootloader and drivers for your Hack build once the OS is installed). You can find out the details at tonymacx86's web site (www.tonymacx86.com).

THE HARDWARE

With the proviso that you understand we can't guarantee this set of components will work for every future Mac OS X release, this is what we'd choose to build a Hackintosh from scratch.

CPU: INTEL CORE I5-3570K

My pound to your peanut says Haswell will eventually join the Hackintosh family list of options, but at the time of writing, tried and trusted is the way to go and that means an Ivy Bridge build. The Core i5-3570K gives you overclocking options and is the best-value Ivy Bridge-grade CPU.

MOTHERBOARD: GIGABYTE GA-Z77-D3H

If you can get hold of Gigabyte's more expensive GA-Z77-DS3H, it's considered the best all-round option, but it's hard to find. The budget GA-Z77-D3H appears to offer good success – one or two builders have had trouble getting the integrated audio working, although there's a working fix for this. You'll also need the latest BIOS installed.

GRAPHICS CARD: GIGABYTE GTX 660 TI OC

Yep, this one is a bit long in the tooth, but at around \$280, the GTX 660 Ti is a choice often recommended as working virtually out of the box, which means very little extra work needs to be done. It should even handle *Diablo 3*



ASK US!

Looking to make your perfect PC, but not sure what parts to buy? Every month, our PC expert **Darren Yates** solves a readers' PC building quandary. Email us at contact@apctest.com for your chance to get building!

WARNING

This information is provided for educational purposes only. Building a Hackintosh breaks Apple's End User License Agreement so you wear any consequences. Also, there are no guarantees your Hackintosh will work perfectly. Finally, APC will not provide any support for or help you build your Hackintosh.

SUGGESTED HACKINTOSH BUILD

		COST
CPU	Intel Core i5-3570K	\$265
CPU cooler	Stock cooler	\$0
Motherboard	Gigabyte GA-Z77-D3H	\$119
RAM	8GB DDR3-1600 RAM	\$79
Graphics card	Nvidia GeForce GTX 660 Ti	\$279
Storage - SSD	120GB SanDisk Extreme SATA 6Gbps	\$125
Storage - HDD	1TB Western Digital WD10EZEX Blue	\$69
Operating system	Apple Mac OS X (10.8)	\$21
Case	Corsair 200R Carbide	\$75
PSU	Antec VP-650P 650W PSU	\$83
Total Cost		\$1,115

comfortably. However, you'll need at least Mac OS X 10.7, since the GTX 660 Ti isn't supported by Snow Leopard (10.6). Alternatively, you can use the CPU's integrated graphics and save some cash.

STORAGE: 128GB SANDISK EXTREME SSD, 1TB WESTERN DIGITAL WD10EZEX BLUE SATA HDD

While we're suggesting Western Digital's 1TB Blue drive as low-cost bulk storage, you can install Mac OS X onto an SSD. However, you must use the MultiBeast tool to enable TRIM support manually, as Mac OS X only automatically activates it for Apple-brand SSDs.

POWER SUPPLY: ANTEC VP-650P 650W

We've used this one before and found that it's a good-value PSU made by Delta Electronics, a company that does PSUs well. This 650W PSU should easily handle the combination of a Core i5-3570K CPU and GeForce GTX 660 Ti graphics card.

CASE: CORSAIR 200R CARBIDE

The Carbide is another component we recommend regularly for its low cost. It's also roomy and is one of the more stylish PC cases going around – just what you want for a Hackintosh build.

DO YOUR RESEARCH

We can't emphasise this enough – you must do your research when planning a Hackintosh build. Since this isn't something Apple really wants you to do, support will come from the community only and it's unlikely your build will work perfectly first go. Also, future Mac OS X updates may not work on your hardware. As we said right at the start, there are no guarantees. Of course, if it all gets too hard, you should be able to turn this build back into a Windows 8.1 box with relative ease. **APC**



CASE

Corsair's 200R Carbide is a good budget case that's solid and stylish.

CPU

Until the Hackintosh community gets Haswell sorted, Ivy Bridge is the safer bet.



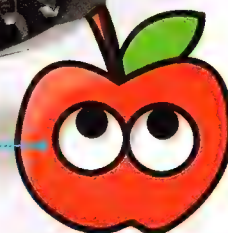
GRAPHICS CARD

Nvidia's GeForce GTX 660 Ti is a bit old, but a good, reliable choice.



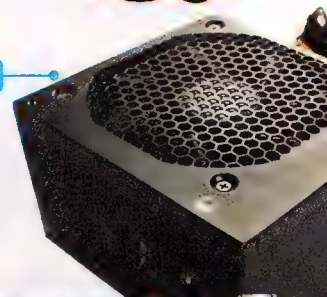
TOOLS

tonymacx86 has done much to simplify building a Mac with his excellent tools.



PSU

Antec's VP-650P should handle this system with ease.

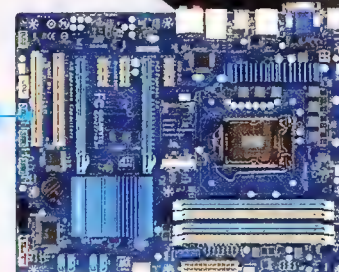


SSD STORAGE

SanDisk's Extreme SSD is fast and relatively cheap – just be sure to enable TRIM in MultiBeast.

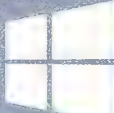
MOTHERBOARD

Gigabyte's Z77-D3H is one of the better Z77 boards still available to build your system with.



IS IT WORTH THE EFFORT?

As a learning objective, building your own Hackintosh can teach you quite a bit about how Mac OS X works. However, in terms of saving bucketloads of cash, it's probably less worth the effort than it once was, particularly when you can pick up a genuine Apple Mac Mini for just \$699. However, if you want to have a go yourself on the cheap, a Hackintosh is a great job for an older Core 2 Duo-era desktop you may no longer be using. This is the first Intel generation Apple launched with and if you already have the hardware gathering dust, this will be by far the cheapest way to build yourself an Apple Hack.



Windows 8 Store

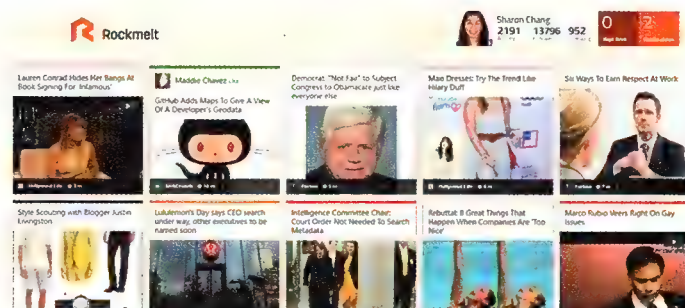
WINDOWS 8 APPS

Rockmelt

This browser's a real know-it-all.

 Free | Rockmelt | tinyurl.com/os9nz7r

Or is it? Rockmelt originally launched a few years back as an ambitious experiment: a desktop web browser for the social media age. After a few years of attempting to compete with the market share (and deep pockets) of Chrome, IE and Firefox, Rockmelt gave up on the unwinnable desktop space and relaunched itself as an all-in-one news and social drip-feed for the app generation (on iOS, Android and Windows 8). While in a sense it's still semi-positioning itself as a web browser alternative, the new feed-based format essentially makes Rockmelt more of a new-fangled news reader like Flipboard, Pulse and their ilk. Regardless of the orientation, it's a pretty nifty app that lets you catch up on the latest in web news and social network activity, and the more you customise it, the more it gives you back in return.

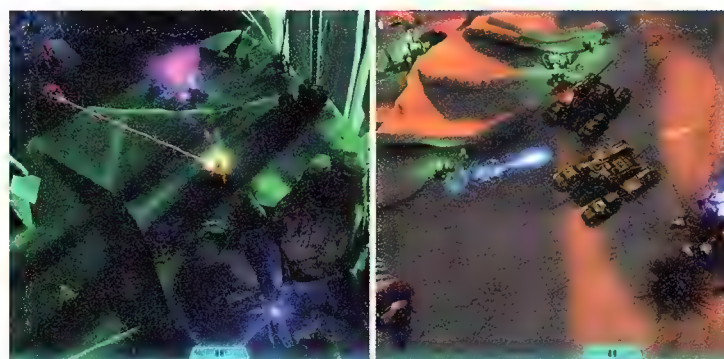
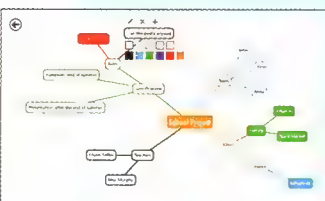


M8! — Mind Map

 Free | Samurai Soft | tinyurl.com/lqlmdwy

Mind mapping is a useful technique for presenting complex information in a visual way, and it can be a handy method to organise research, plan projects, help with creative thinking or stand in as a memorisation tool. M8! by Samurai Soft is pretty much the definition of a no-frills mind mapping app, but for a freebie it's more than enough to help you get your thoughts down with a rough concept and branch out some paths. Be warned, however, if you want to add any colour to your chart, organise your mind map with groups or even simply print it out, you'll

be obliged to fork out \$1.99 per upgrade, which is a little steep in our book. Try out M8! to see if mind mapping works for you and if you decide you need the extra features, perhaps look elsewhere for a more accommodating program.



Halo: Spartan Assault

 \$6.99 | Microsoft Studios | tinyurl.com/nycd3uu

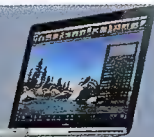
Apple never had much need to prop up the App Store's booming gaming catalogue – the company only ever developed one title itself, a poker game that's no longer available. Microsoft's playing things more conservatively, bringing the Xbox's flagship gaming property to Windows Phone 8 and Windows 8 exclusively (ie. sorry 'PC' owners). The first-ever non-Xbox *Halo* has thus arrived and the migration is a mixed bag. Forgoing the FPS genre for a top-down shooter, *Halo's* setting has very much made the transition, but losing the first-person perspective results in a much less immersive experience overall; with the camera floating above your Spartan, it just feels like a much more detached (and generic) *Halo*. Stellar production values and crisp graphics across 25 levels mean there's some good value here, but we can't help feeling that *Spartan Assault* is a bit of a misstep.

wordBrush

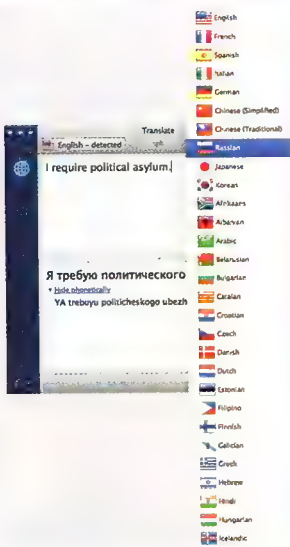
 Free | Pointy Stick Apps | tinyurl.com/psnqmaj

Everybody's a graphic designer these days – or we've got the tools at our fingertips to try, at least. wordBrush is a fun, free example of the new range of casual typography apps that let people jazz up their photos and images with customised text. The kicker in this case is that you can literally paint your text onto the canvas with your finger or the mouse, with the words appearing exactly where you draw. There's support for up to 200 built-in fonts, plus a limited number of drawing tools to help introduce some pizzazz, with extra theme packs available via in-app purchase. Freaking out your friends and colleagues with hidden 'All work and no play makes Jack a dull boy' messages was never so typographically liberating.





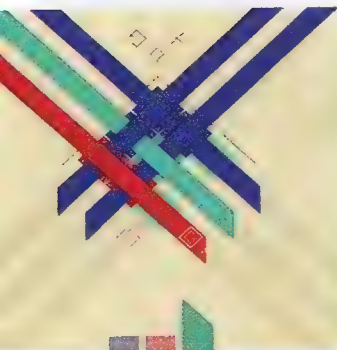
Mac Store | APPS



Universal Translator

i Free | NibiruTech | [UniversalTranslator](#)

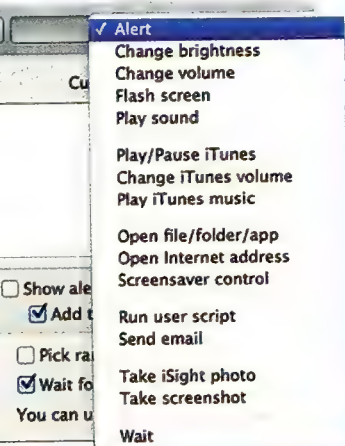
The internet is a global sort of place and more and more often these days, I find myself reaching for an online translating service just to understand comments on Twitter or to politely decline Facebook requests. I hope I'm being polite, anyway. Universal Translator is a simple, clean app that allows you to enter text in any of a huge number of languages and translate to a language you understand – or vice versa. You can even copy and paste text, and it will detect the language if you don't happen to know it. Should you need to learn how to say a particular phrase out loud, the app will speak it for you. Before you go saying it to the folks at Customs, though, I'd run it back through the translator just to be sure. After all, it's illegal to bring a hovercraft full of eels into some countries.



Strata

i \$2.99 | Graveck | [tinyurl.com/StrataMac](#)

Strata is a fairly simple yet mind-bending puzzle game involving placing 'ribbons' in layers on a grid. The colour of the top ribbon over each square must match the colour of the square – simple enough. Trust me on this, it's maddening. What's more, it's stunningly beautiful. Not only the graphics, but the sound effects are immersive, almost meditative. You can easily lose quite a bit of time playing *Strata* and not regret it one bit. It's a game that's as easy on the eyes as it is good for the soul.



Clockwise

i \$7.49 | ACT Productions | [tinyurl.com/ClockwiseMac](#)

When OS X 10.9 ships, it will include the ability to trigger certain actions based on calendar events. However, it seems at this stage that the feature will be fairly rudimentary, at least at first. Clockwise is what time-triggered automation on the Mac ought to be. You can set reminders to be triggered at any interval from minutes away to years, with repeats as complex as you can conceive. Want to have your Mac wake you up with 'Eye of the Tiger' blaring out on a loop, increasing the volume each time, but only on Mondays and Thursdays in months other than November? Easy done. If you have a few skills with AppleScript or Automator, you can get Clockwise to trigger those scripts whenever you need it to, or you can set up keyboard shortcuts to trigger them at will. Actions can also be triggered by the completion of other actions. You get the picture. Unfortunately, it requires Mountain Lion.



The Elements

Shut up and take my money.

i \$20.99 | Touch Press | [tinyurl.com/ElementsOSX](#)

The Elements is one of the best apps for the iPad, if you're at all interested in chemistry or physics or how the world works.

Designed by renowned element collector (and co-founder of Wolfram Research) Theodore Gray, it was one of the first apps demonstrated for the iPad and remains unsurpassed in its interactive wondrousness. Basically, if you have an iPad and a curious mind, you ought to get it.

Touch Press has now created a version of The Elements for OS X, complete with all the interactivity, rotatable VR photos of elements and masses of background information.

Plus it's added videos of various elements 'in action' – basically showing off cool reactions, explosions and wild experiments.

The videos aren't unlike others you'll find on YouTube (indeed many are on YouTube), although having them all in the one place, paired with the other extensive resources The Elements provides, makes this a very cool tool for students and teachers.

App Store | IOS APPS

On The Way to Woodstock

Brimming with information about the Festival.

i \$5.49 (iPad) | 955 Dreams | tinyurl.com/PathToWoodstock

I have to admit slight disappointment with On The Way To Woodstock, as I expected it to include video footage of at least some of the actual performances from that legendary concert. If it does, there's not much of it. But it's still a worthwhile app anyway.

It's a sort of timeline, showcasing the years leading up to and immediately after August 1969, with a focus on the three days of the Woodstock Festival. The idea is to give a context – socially, politically and musically – for the event itself. There's a lot of useful information, heaps of photos (warning: there's some nudity) and indeed music to keep you informed and educated.

Unfortunately, a lot of the video content relies on links to YouTube, so if things have been removed for copyright reasons or blocked geographically, you'll come across quite a few blanks. If the app had included downloadable videos it would have been better, albeit also more expensive.

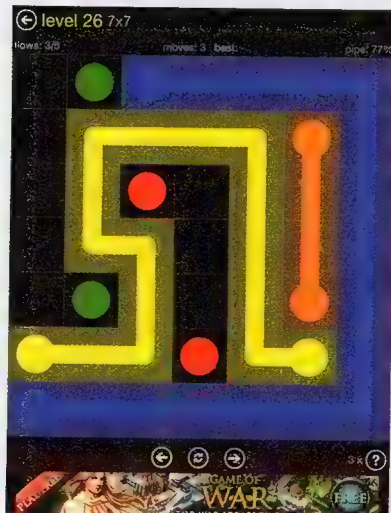
It's not the app to get if you want to get the Woodstock 'experience', but if you want to know why Woodstock happened, it's groovy, man.



Flow Free

i Free | Big Duck Games | tinyurl.com/BigDuckFlow

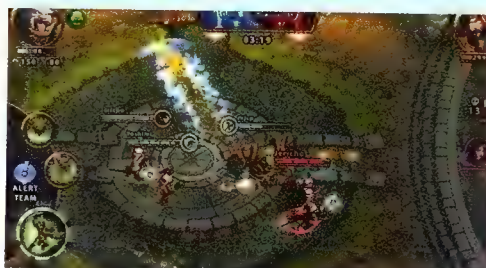
Flow Free is incredibly simple – draw lines between dots of like colour on a grid and make sure the lines don't cross – but maddeningly addictive. It starts ridiculously easy, but gets progressively harder as the grids get bigger and more coloured dots appear. It's a terrific casual game and a terrifying time-thief.



Solstice Arena

i Free | Zynga | tinyurl.com/SolsticeArena

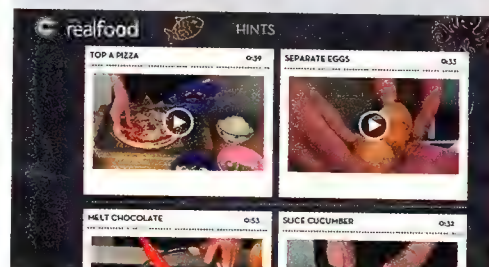
Zynga is best known for multiplayer games like Farmville and Words With Friends, peaceful games in which conflict is rarely heated. Solstice Arena is something of a departure – a multiplayer online battle arena (MOBA) game in which you play with or against friends in armed combat to the death. I haven't played many MOBAs, so I can't really judge whether this one is better or worse than others, but on its own merits, it's fun. The combination of simple controls and sophisticated gameplay make for an engaging experience, and the graphics are most impressive for a mobile game. As with so many games these days, eventually you're asked to chip in some cash to upgrade your 'Hero' in order to win battles and advance, but I got quite a while of gameplay in for free before that happened.



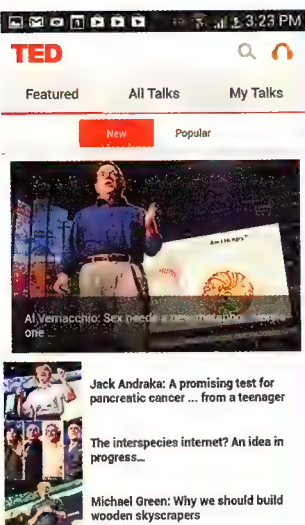
Great British Chefs Kids HD

i Free | Great British Chefs | tinyurl.com/BritishChefsKids

Great British Chefs is a series of apps based on a popular TV cooking show. Kids is well-produced, with a slick interface. It includes plenty of recipes, as well as background info on the chefs who designed them. If you're in the UK, you can also design meal plans and shopping lists based on what's available at your nearest Tesco. The Kids app touts itself as featuring recipes designed to be kid-friendly; they feature plenty of ways in which kids can help with the cooking (instructional videos are included). The interface is maybe a bit unintuitive, but there's a good search function to get around that. Some of the recipes are a bit baffling: why does a chicken and chickpea soup call for four glasses of wine? My kids don't drink nearly that much. However, the majority of the recipes are indeed kid-friendly, so if you've got kids, it's a great place to start.



Google Play | ANDROID



TED

i Free | TED Conferences | tinyurl.com/l8rbfk2

YouTube is great for a laugh, but if the old grey matter is calling out for a little digital nourishment and cerebral stimulation, check out the free official TED app. TED is a global non-profit organisation that puts on short talks about important ideas: ideas about the environment, technology, the economy, science, art, culture and everything in between. TED speakers run like a veritable who's who of world-stage VIPs: everyone from Bono, Elizabeth Gilbert, Al Gore and J. J. Abrams have taken part, so there's a huge amount of interesting stuff on offer. All 1,500+ (and counting) TED talks are viewable, downloadable and listenable within this one nifty app. The latest 2.0 version brings on board translations in 20 new languages, ensuring TED's electric ideas should disperse even more dynamically.



Perfect Viewer

i Free | Rookie001 | tinyurl.com/7tmauwg

It's only taken them a few years to catch on, but the big comics publishers – Marvel and DC, plus a host of smaller labels – are starting to get their digital acts together, with increasingly sophisticated offerings as they make the transition from print to tablet, partly with the help of platforms like comiXology. But what if you've already got a sizeable digital comic book collection? Perfect Viewer to the rescue! Aptly named, it sports a huge gamut of customisation options so you can read your comics exactly the way you want, with support for multiple file formats (CBR, CBZ and so on). It's totally free, with various donation and commercial add-ons also available. Comics are naturally a better fit on tablets than on smartphones, but at least today's large-screen phones make it a little bit easier on the eyes...

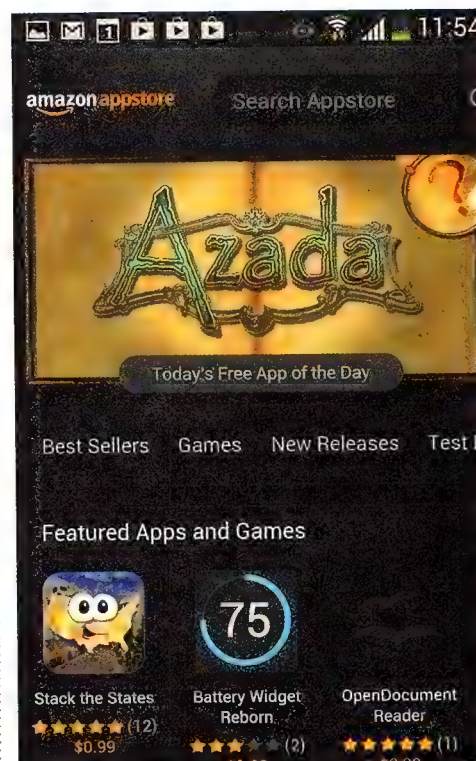
Tiny Thief

i \$3.80 | Rovio Stars | tinyurl.com/p2qsp5b

It's nice to see that the folks at Rovio Entertainment – the Finnish gaming powerhouse responsible for the mega-selling *Angry Birds* phenomenon – aren't just sitting around counting their money piles like Scrooge McDuck. In addition to their own titles, the company has now morphed into a general publisher, steering promising-looking third-party games to release. The latest such is *Tiny Thief* by 5 Ants, a very delightful little puzzle/adventure game that has you starring as the titular anti-hero charged with the task of outsmarting the castle guards and other nefarious sorts as he steals his way through a



number of medieval-themed levels. It starts off easy, but gets tricky quickly, and you won't want to stop once you've started. Be warned: the cute has been turned up to 11 on this one.



Amazon Appstore

Think outside the box for free apps (and more).

i Free | Amazon | www.amazon.com

The strength of Android, at least from a user standpoint, lies in its relatively open nature. There are multiple examples of this, but a significant one – which many users perhaps aren't aware of – is that the operating system allows you to install apps from anywhere you like, not just the default app store. Try that on your fancy iPhone 5, Apple fanboys.

Because of this, there are a number of alternative app stores from which you can download free and commercial apps. The most significant of these is Amazon's Appstore, which has been around for some time now, but only recently became available to Australian users. Just head to Amazon's site on your mobile and follow the simple instructions to install Amazon Appstore.

The best bit: Amazon Appstore discounts a commercial app to free every day, among other frequent promotions, so it can't hurt to take a look, right?



Windows Store

WIN PHONE 8

Hipstamatic Oggl

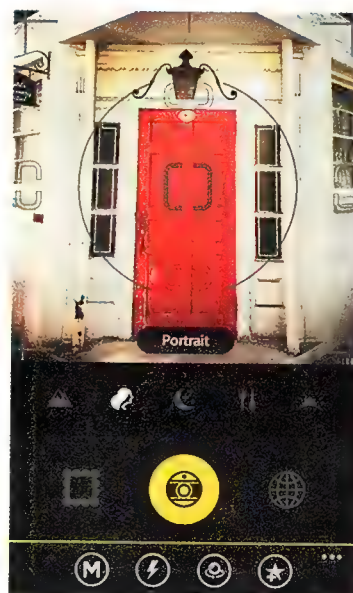
No official Instagram yet? No worries.

Free | Chengdu Everimaging Science and Technology | tinyurl.com/l3fs2kf

Microsoft and Nokia have been practically champing at the bit to bring the world-conquering Instagram to Windows Phone... but as yet to no avail. There are a number of unofficial third-party apps that can provide you with an Instagram-esque experience on the sly, but as the recent blocking of crowd favourite Instance proved, Facebook doesn't take too kindly to apps that trample over Instagram's API.

However, Hipstamatic Oggl provides official access to Instagram for WP8 users via a licensing arrangement – with a few caveats. First, you'll need a high-end phone (1GB of RAM minimum). Second, it's uploads only: you can't view Instagram in the app, only export to it. Third, the overall focus of the app – Hipstamatic's own platform/UI – is quite different to Instagram. Fourth, there are in-app purchases.

Provided you can deal with all of the above, Hipstamatic Oggl will make some WP8 users rather happy.



Fotor

Free | Chengdu Everimaging Science and Technology | tinyurl.com/ao8n8nf

Fotor redefines ubiquitous. This almost unavoidable photo editing app is available on virtually every platform you can name and there's even a Chrome extension. Not that you'd want to avoid it, by the way. It's handy, it's free and it's perfectly good for minor editing and effects. The Windows Phone 8 version makes it a cinch to edit images or make collages. All the usual suspects are here: there's one-touch autofix (with variable intensities of 'fixing'), crop, rotate, filters, borders, manual adjustments and the obligatory tilt-shift. Once you're done tweaking, it's just one tap to share. You don't get as much control as the desktop versions (understandably), but there's a lot to like in Fotor. It won't cost you a cent and there aren't even any ads.



Battery Performance

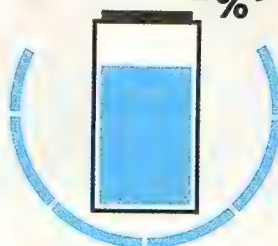
\$2.49 | Dev-Software | tinyurl.com/k4fmoqp

Knowing a little bit about how batteries operate can help you get the most out of your device. Battery Performance gives you a much more comprehensive overview on your battery stats than Windows Phone 8's built-in profiler allows. The app shows you your battery capacity, current level of charge, estimated life left (days, hours, minutes, including talk time and web use estimates) and consumption rate per hour. It automatically logs your battery strength at customisable intervals, provides optional notifications if your battery level drops to a certain point, supports Live Tile pinning and even introduces a gamification element by comparing your battery stats against other users' scores around the world.

Battery Perf

ON BATTERY

79%



CastleMine

Free trial/ 99c | Diffraction Studios | tinyurl.com/mychql5

When you think about it, tower defence games don't really have to involve towers per se. As long as you've got a steady stream of creeps heading toward you down your elaborately devised path/maze/trench of death, it doesn't matter what kind of defensive structures you erect. 'Towers' is just a catch-all term for turrets. In this addictive little TD title from Diffraction Studios, the horde of evil approaches from the very soil underneath your castle. To build your defences and eradicate the baddies, you've got to dig down deeper into the dirt, although doing so only lets loose more of the little devils! A fun game and a lesson in the importance of carrying out a proper pest inspection before you purchase your dream home.





App World | BLACKBERRY

27 mins ago	10:32 am	10:49 am
	Real-time data unavailable	
12 mins ago	Town Hall Platform 1	Lewisham
	10:47 am	11:04 am
	Real-time data unavailable	
3 mins ago	Town Hall Platform 1	Lewisham
	11:02 am	11:19 am
	Real-time data unavailable	
18 mins ago	Town Hall Platform 1	Lewisham
	11:17 am	11:34 am
	Real-time data unavailable	
3 mins ago	Town Hall Platform 1	Lewisham
	11:32 am	11:49 am
	Real-time data unavailable	
48 mins ago	Town Hall Platform 1	Lewisham
	11:47 am	12:04 pm
	Real-time data unavailable	

Real-time data updated at 10:59:01

TripView Sydney

i \$2.99 | Nicholas Maher | tinyurl.com/oafw75b

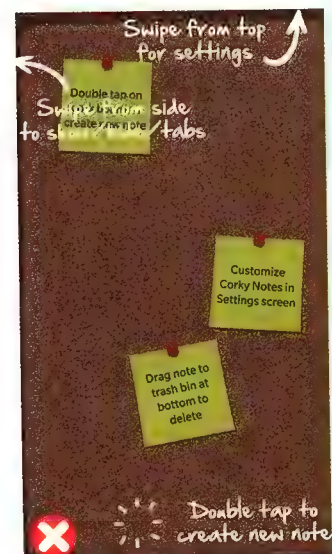
For the price of a bus or train ticket, you can ensure you never miss your bus or train again. How? TripView Sydney has been a mainstay of mobile commuters for years now, with its handy bundling of bus/train/ferry routes and timetables, although the latest version goes one better, with real-time tracker updates on the position and early/late status of each service. It's wonderful being able to time your trip to the bus stop perfectly, rather than having to turn up 10 minutes early just in case and then still wait extra if it's running late. Sorry non-Sydneysiders, this one's clearly not for users everywhere, but you can expect this kind of functionality to come to other transport networks in time, especially in metropolitan areas.



Modern Combat 4

i 99c | Gameloft | tinyurl.com/lc25mkm

It's not exactly news that one of BB10's toughest challenges in the smartphone battleground is securing enough of the must-have apps that other platforms enjoy, but one area where BlackBerry is finding success is in striking up partnerships with big-name developers. Mega-selling game company Gameloft is a case in point and *Modern Combat 4* can be had on BB10 for a fraction of the price elsewhere. Gameloft specialises in expertly crafted 'homages' to other famous titles and this one's debt to *Call of Duty* is plain. But *CoD* hasn't arrived properly on mobile anyway and when the imitation is this good, do you care? *MC4* is probably the best multiplatform mobile shooter currently around, with incendiary graphics, cheesy dialogue, a strong campaign and full multiplayer. Get it while the promo lasts. Tip for parents: harsh language and very violent.

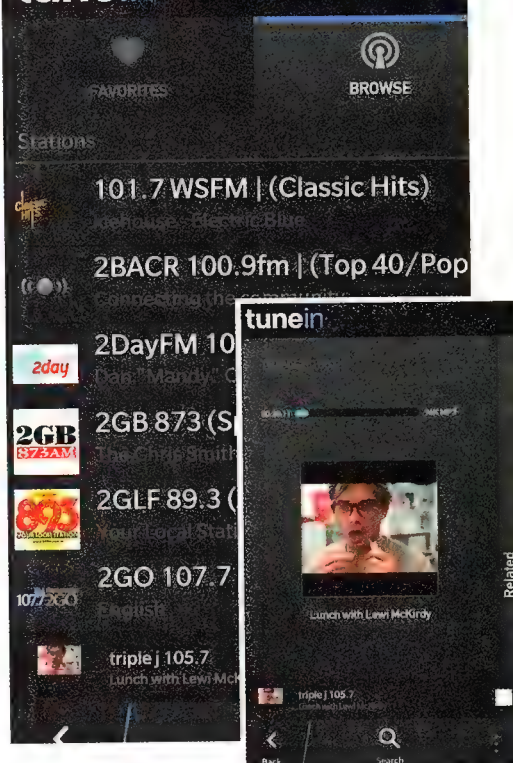


Corky Notes

i Free | qbotron | tinyurl.com/kislxwe

Opinions vary when it comes to the best practices for Getting Things Done. Some people swear by digital productivity tools, like mobile and web apps that can help you sync tasks across multiple devices, establish varying degrees of priority, calendarise with reminders, collaborate with colleagues and so on. Others will tell you most of that functionality is merely a distraction in itself and swear by simple pen and paper as the most effective way of listing and executing your to-dos. Corky Notes offers a charming hybrid. It's a simplistic take on the former category, but presented endearingly as a cork board full of post-its. Somehow the old-world visual metaphor manages to make your task list that little bit more approachable and thus doable. The free app comes with yellow notes only, with extra colours available via IAP. But ask yourself before you purchase: will pink and blue post-its actually increase your productivity?

tunein



TuneIn Radio

70,000 stations and counting.

i Free | TuneIn | tinyurl.com/m3rnb3f

With so much fuss these days about streaming music platforms like Spotify and Pandora, it's easy to forget about the upstart that pioneered the whole streaming shebang: radio. TuneIn Radio is a ridiculously easy-to-use digital radio app that instantly plugs you in to some 70,000 live radio broadcasts across the globe. You can browse local stations or filter through genres like music, talkback, news, sports and language, not to mention hundreds of sub-genres in each category. If you somehow run out of stuff to listen to among all that, there's also two million podcasts for on-demand playback. And in case you're still not convinced, it's all totally free, which goes some way to explaining TuneIn Radio's mass appeal, with 40 million monthly users on the books. Just keep an eye on your data, folks. **ETC**

STOP THE SNOOPS

From massive spy rings to tracking cookies, nearly everything you do online is being tracked in some form. Nathan Taylor reveals who's watching you and how to avoid the snoops.

Back in 2001, Telstra signed an agreement with the US Department of Justice (DOJ) and Federal Bureau of Investigation (FBI). Reach, the intercontinental bandwidth provider jointly owned by Telstra and Hong Kong's PCCW, would be required to build a data centre in the US, staffed by US citizens, through which all of its traffic into and out of the US would be run.

That data centre would need to be able to provide the US government with traffic and call logs as well as wire intercept capabilities on short notice. In essence, the US wanted an easy and secure mechanism for tapping into the undersea cables managed by Reach – and it got it, allowing it to monitor all signals, calls and call metadata whenever it felt the need.

Later, in 2003, international bandwidth provider Global Crossing faced a similar dilemma. The American company was due to be sold to an Asian firm. Fearing that it would lose easy access to the data stream, the US DOJ put up a series of roadblocks preventing the sale until a deal called the 'Network Security Agreement' was made. As with the Telstra deal, it required that the new owners maintain a US-staffed data centre through which all traffic would pass into and out of the US, providing an easy mechanism for the US government to tap into all international communications. Unlike Telstra, Global Crossing was actually quite open about the deal, even posting a page on its web site detailing the specifics of the arrangement.

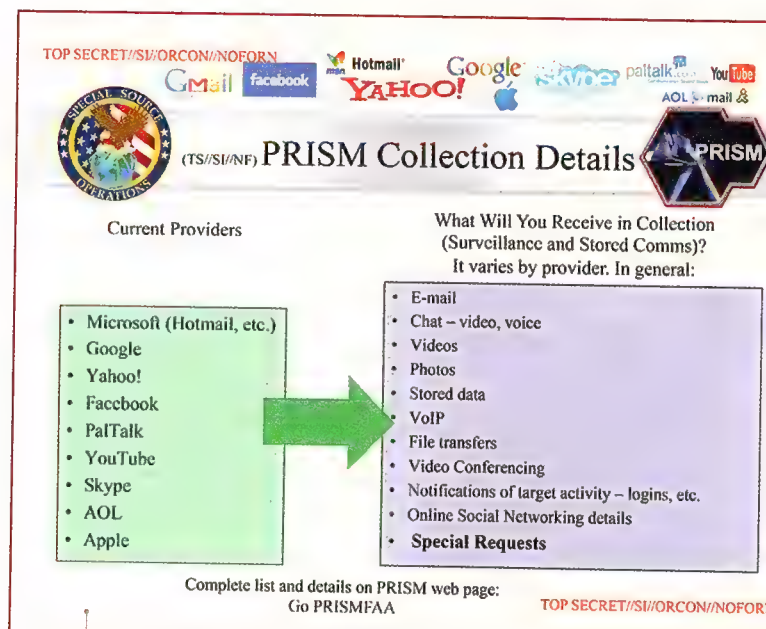
According to the *Washington Post*, these deals became a model for all telecomms providers wanting to do business in the US. There's even a group within the US Federal Communications Commission (FCC) that enforces these deals. Providing the government with easy access to telecomms data is essentially the cost of doing business in the US.

Officially, these deals exist only to provide a mechanism for US law enforcement and security agencies to access internet backbones, and so far as we know are not used to monitor every piece of internet data crossing the oceans. That's not to say that the US government is above that sort of large-scale monitoring.

In 2006, a former AT&T technician named Mark Klein revealed the existence of the now infamous Room 641A. Run by the US National Security Agency (NSA) in co-operation with AT&T, Room 641A was located in AT&T facilities in San Francisco and was fed with fibre optic cables connected to the AT&T internet trunk cable. Every piece of data that flowed into the facility went through Room 641A, where it was

analysed by a Narus STA 6400 supercomputer running NarusInsight, a system for real-time analytics of network data. NarusInsight could tell when an individual user was doing what: what application they were running, what protocols they were using and which web sites they visited. It could also detect and monitor the use of keyphrases in emails, and keep logs of visitors to a given web site.

Klein also said that he was told of other similar black rooms that operated in facilities all around the US, monitoring nearly all the traffic traversing the country, including both international and domestic traffic. This claim was later backed up in a 2012 *Wired* magazine interview with William Binney, a former NSA mathematician. "I think there's 10 to 20 of



One of the NSA slides, being quite specific about which companies are involved and what data can be extracted from them.



them," Binney told *Wired*. "That's not just San Francisco; they have them in the middle of the country and also on the East Coast."

The revelations of mass surveillance by the NSA didn't come as a surprise to many, however. The mass monitoring of communications backbones had been known about for years. The Echelon satellite signal intelligence system, run by the US, UK, Australia, New Zealand and Canada, had been known about for decades, for example. But it wasn't until this year that the truly massive scale of government surveillance was cast into the limelight.

THE SNOWDEN LEAK

Edward Snowden, a 30-year-old security expert, was a former employee of both the NSA and CIA. He had worked directly with both, but also and most recently as a subcontractor on a secret NSA project in Japan.

In an interview with Glenn Greenwald for *The Guardian* newspaper, Snowden outlined the incredible scale of government phone and internet tracking conducted by the US and allied governments, including Australia.

He did more than provide an interview – he gave *The Guardian* a 41-panel PowerPoint presentation used for the training of US security personnel, mentioning a dizzying array of NSA and allied agencies' surveillance programs. For many of those programs we have little more than bullet point descriptors; for some we have only codenames and virtually nothing else.

PRISM: ALL YOUR DATA BELONGS TO US

Of all the programs revealed by the Snowden leak, none has gotten as much attention as PRISM. PRISM is a program designed to extract important information from major US-based providers of internet services. Nine companies in particular are mentioned as being part of the program: Microsoft, Google, Apple, Facebook, Yahoo!, YouTube, Skype, AOL and Paltalk.

Here's where things get a little murky. In the original *The Guardian* interview, Snowden claimed that the NSA has direct access to the data stored on the servers of these companies, and can effectively access it unilaterally and without a court order, as long as there's 'reasonable suspicion' that one of the parties involved is not a US citizen.

However, every company listed in the leaked NSA slides has denied that there's some kind of open back door onto their servers giving the

CRYPTOGRAPHIC PHONES

It turns out it's not that hard to intercept a mobile phone call. IMSI (International Mobile Subscriber Identity) catchers are illegal for civilian use in Australia and elsewhere, but they're not at all difficult to obtain or even build if you have the know-how. In 2010 at the Defcon conference, a hacker named Chris Paget showed how he built an IMSI catcher from his laptop and two RF antennas.

An IMSI catcher allows a hacker to perform a man-in-the-middle attack on your mobile phone, tricking it into thinking that the catcher is a legitimate cell tower and forcing it to connect to the catcher. GSM calls can then be forced to run unencrypted and listened in on, and even fake SMS messages can be sent that appear to be from an intercepted phone.

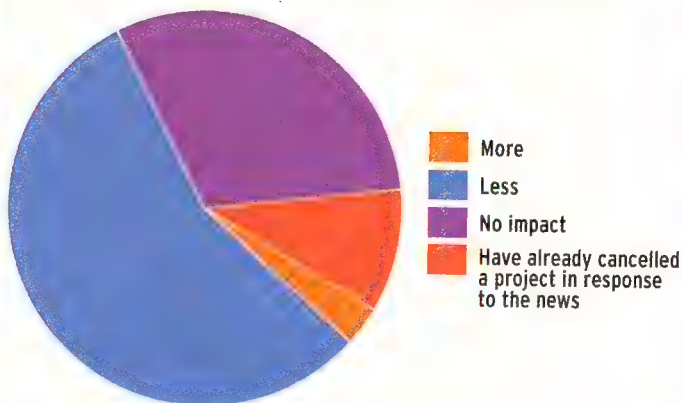
For many individuals needing maximum privacy, a secure cryptographic phone is the answer. They are popular with solicitors and journalists in particular, but any business that requires maximum confidentiality can use them. Cryptographic phones add an extra layer of encryption on the phone call, usually the uncrackable AES-256. Of course, both the caller and receiver need to support encryption, and the phones usually need to be from the same manufacturer.

There are a number of providers of cryptographic phones in Australia. If you feel like you want or need that extra layer of protection, you can try GSMK (cryptophoneaustralia.com) or Koolspan (www.koolspan.com) to start. You can also look to a variety of encrypted VoIP solutions, such as Jitsi (jitsi.org) or RedPhone (whispersystems.org), with the latter providing encrypted calls from Android phones.

NSA *carte blanche* to access anything stored on them. They have all conceded, however, that they do provide information in response to warrants and subpoenas. "We provide customer data only when we receive a legally binding order or subpoena to do so, and never on a voluntary basis. In addition we only ever comply with orders for requests about specific accounts or identifiers. If the government has a broader voluntary national security program to gather customer data, we don't participate in it," Microsoft representatives told *TechCrunch* earlier this year, and the other providers have given similar responses.

Even if this is true, it turns out the barriers to get such warrants are ridiculously low for the NSA. Requests for surveillance warrants in the US go through the secret Foreign Intelligence Surveillance Court (FISC), which denies them very, very rarely. As revealed by the *Wall Street*

(For non-US residents only) Does the Snowden Incident make your company more or less likely to use US-based cloud providers?



The PRISM nine have good reason to be concerned with loss of confidence. A survey of non-US companies by the Cloud Security Alliance revealed that 10% of them had cancelled contracts after the PRISM revelation. Source: Cloud Security Alliance.

Journal, between 2000 and 2012 there were 21,660 warrants applied for. A grand total of 11 were rejected.

Under the US Foreign Intelligence Surveillance Act, US citizens are afforded some protections from surveillance. We foreigners get none – if the NSA wants our stuff, it gets it – and it's clear that the companies named as part of the PRISM program are all concerned about the erosion of confidence in their services that this creates.

Facebook and Google, for example, are currently in discussions with the US DOJ to gain permission to be more open about the number and nature of national security requests they receive. Facebook already received some permission and revealed that there were 9,000-10,000 national security requests for user data, affecting 18,000-19,000 user accounts in the second half of 2012. Meanwhile, Yahoo! recently won a court case to declassify 2008 court papers revealing how much it objected to the PRISM program.

BEYOND PRISM

Although it has received the most press, PRISM was one of the many programs revealed by the Snowden leak. He also revealed a number of other programs, including Upstream and Tempora, which involve the wholesale monitoring of internet backbones, with sophisticated intelligence software to filter through the firehose of internet data and find potential threats.

There are many more mentioned in passing, most of which we know little more about than the codename: Nucleon, Stormbrew, Oakstar, Marina, Traffic Thief and others, but the ones we know at least a little about are listed below:

- **Boundless Informant:** A system for analysing and visualising vast amounts of intelligence information, drawing from a variety of intelligence sources.
- **Dropmire:** A surveillance program that targets foreign embassies.
- **Echelon:** A massive satellite, microwave and terrestrial network monitoring system managed by the 'Five Eyes' (Australia, Canada, New Zealand, the UK and the US).
- **Fairview:** Aimed at the collection of foreign phone internet and email data through data sharing alliances between US and international telecomms providers.
- **Main Core:** A database of the financial records of US citizens believed to be threats to national security.
- **Mainway:** A massive database of telephone call metadata (that is, who called who and when), gathered from the four largest telecomms providers in the US.

TOP SECRET//SI//ORCON//NOFORN



Gmail Facebook

Hotmail

Google

SKYPE

talk

YouTube

YAHOO!

Apple

AOL

mail

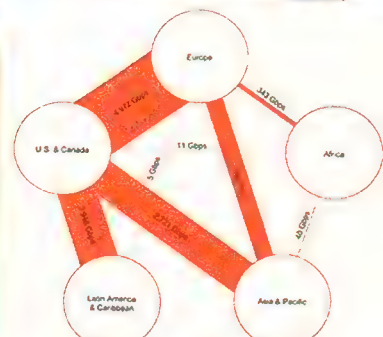
&

(TS//SI//NF) Introduction

U.S. as World's Telecommunications Backbone



- Much of the world's communications flow through the U.S.
- A target's phone call, e-mail or chat will take the cheapest path, not the physically most direct path – you can't always predict the path.
- Your target's communications could easily be flowing into and through the U.S.



International Internet Regional Bandwidth Capacity in 2010

Source: Teleography Research

TOP SECRET//SI//ORCON//NOFORN

As shown on the leaked slide, a massive amount of the world's internet data flows through the US, giving the NSA a vast amount of data to tap into.

- **Pinwale:** A searchable database of intercepted and stored emails from both US and foreign sources.
- **PRISM:** A system for extracting data from major US providers of internet services, including Google and Microsoft.
- **Stellar Wind:** Like Boundless Informant, this is a system for managing and mining data gathered by the NSA.
- **Tempora:** Similar to Upstream (see below), but in this case run by the British Government Communications Headquarters (GCHQ). It's an 18-month-old program that has taps into 200 fibre optic backbones running across the Atlantic, and stores all metadata from those lines for up to 30 days and content for up to three days.
- **Upstream:** A network of systems for hoovering up and analysing the vast amounts of data flowing across internet backbones in the US. Possibly related to Room 641A.
- **X-Keyscore:** An Australian and New Zealand-led program, believed to be focused on monitoring and translating email data.

CORPORATE DATA RETENTION

In June this year, the Australian Federal Government gave the final verdict on a proposal to enforce higher levels of data retention on telecomms providers. Under the proposal, a record of what sites you'd visited and who you'd called would be stored by telcos and ISPs for up to two years. It was argued that this would aid Australia's national security efforts.

Of course, the proposal could not have come out at a worse time for its proponents. Soon after the explosive Snowden leaks, the proposal was shut down by the Parliamentary Joint Committee on Intelligence and Security, and Attorney-General Mark Dreyfus announced that the government would not further pursue data retention legislation 'at this time'.

However, the failure of the proposal doesn't mean that private companies aren't devoting considerable energy to tracking our every move. After all, governments aren't the only ones hoovering up vast amounts of information about our online activities.

Google keeps a log of your internet searches for up to nine months and even then, it only deletes the last octet (the last number of the four-number IP address) of your IP address from its records. Google Tasks – used by Google Calendar and Gmail – may be retained on record for up to 30 days after you delete them. When you delete an email in



Gmail, a copy of it is still kept on Google servers for an indeterminate amount of time, ostensibly for recovery purposes in case of occurrences of accidental deletion.

Meanwhile, Microsoft keeps search data for six months and Yahoo! for three. Facebook keeps data from deleted accounts for up to 90 days and will keep other account information indefinitely, as long as it's active on an account. A Facebook message must be deleted by both the sender and recipients to be removed from the system.

And then there are the tracking cookies. Cookies were originally designed for individual sites to maintain preference data, but they started being used for advanced user tracking. Within an individual site, cookies are often used to record exactly what pages you visited and when, giving the site owner a complete record of your activities on that site.

What's worse are the cross-site cookies that allow your web activities to be tracked on a massive scale. For security reasons, cookies are meant to be limited to specific sites: a cookie is linked to a domain and only web sites on that domain can request and modify the cookie data. But now, nearly every site has page elements such as Facebook widgets and ad banners that call on an external server and allow you to be tracked by third-party cookies. In effect, an online ad agency can track you every time you visit a page on which one of its banners is placed, and Facebook knows every time you visit a site with a Facebook widget embedded.

KEEPING IT TO YOURSELF

So with all this tracking and monitoring going on, how do you protect yourself from digital snoops? There are a variety of methods to protect yourself – some convenient; some not so much.

BROWSING

If you really want to prevent anyone from tracing your online activity, you can't go past the Tor Browser (www.torproject.org). The Tor network has been in operation for a number of years now and it uses a technique

called onion routing to almost completely obscure connection endpoints. In effect, when you're using the Tor network, each connection you make is relayed through several other computers (and conversely other people's connections are routed through yours), obscuring your IP address and making backtracing a connection practically impossible.

Tor can and is used for a variety of services. There are Tor-based instant messaging tools, file transfer and even add-ons for tools like Thunderbird that use Tor to obscure connections and provide anonymity. Most commonly, though, it's a service used for web browsing with complete anonymity.

To use the Tor browser, download it from the 'Projects' section of the Tor Project web site, extract the files and run it. A pop-up will appear called the 'Vidalia Control Panel', telling you about your connection status, then the browser itself will appear with a start page detailing your apparent IP address – not your actual IP address, but the one that any web sites you visit will see. You can change that IP address at any time just by clicking on 'Use a New Identity' in the Control Panel.

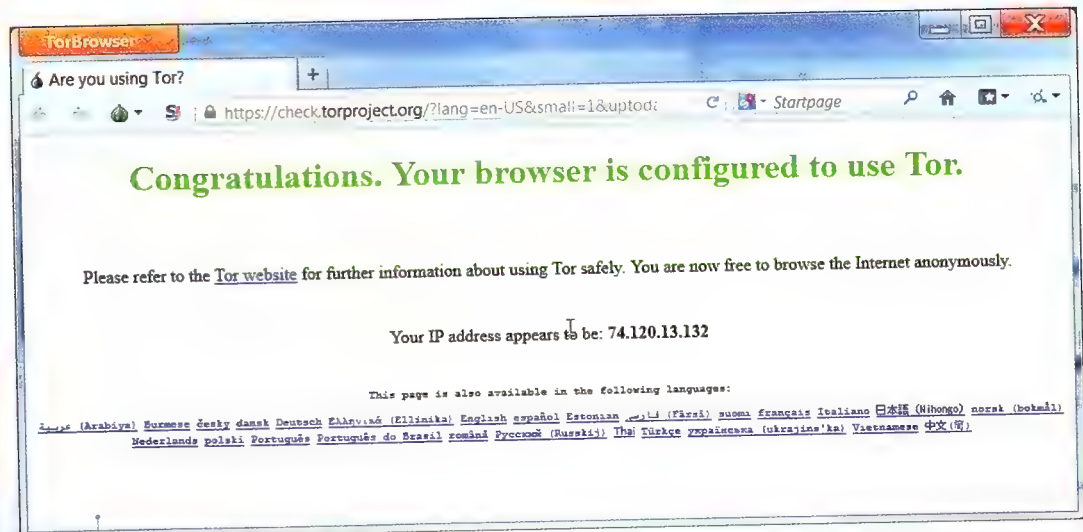
The browser itself is very basic, being essentially a stripped-down version of Firefox ESR (Extended Support Release). It has the default search engine set to Startpage (see 'Search' below) and HTTPS Everywhere built in (more on that in a second).

Using the Tor browser provides excellent anonymity, but it's rather hardcore. Because you're routing through several other Tor users' PCs, you're operating at lowest-common-denominator speeds. Web sites are often painfully slow to load, though sometimes you can get lucky with a good connection.

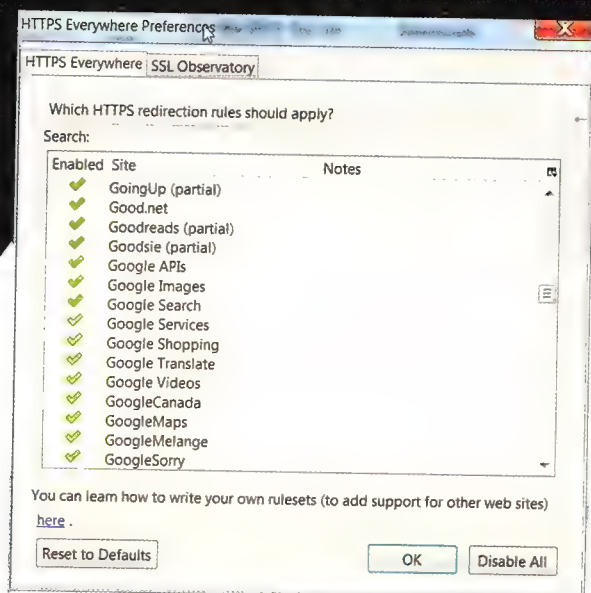
If you don't want to go quite as far as Tor, you can still install the HTTPS Everywhere (www.eff.org/https-everywhere) add-on for Firefox and Chrome to try to maximise network security. HTTPS forges an encrypted tunnel between you and the sites you visit, preventing any network intercepts from deciphering the communications. It won't hide your IP address from the destination web site, nor will it prevent people from knowing which sites you're visiting, but it will prevent Wi-Fi snoops



The 'Vidalia Control Panel', which manages your connection to the Tor network.

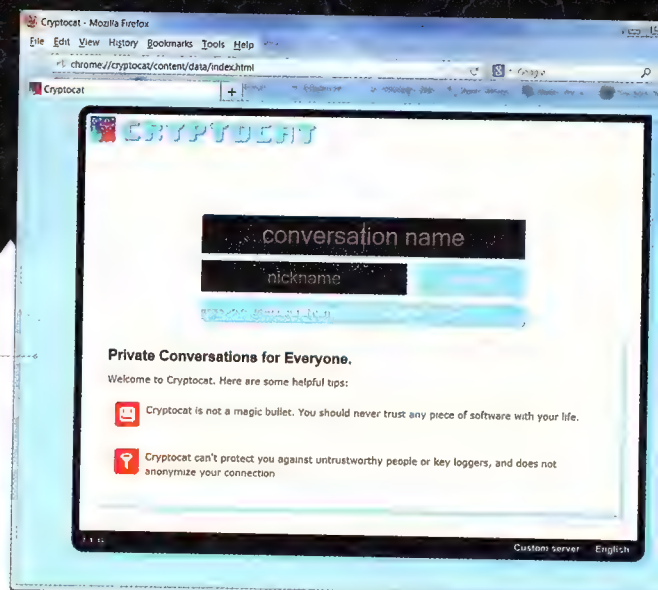


The Tor browser home page tells you what your new 'fake' IP address is.



HTTPS Everywhere forces many web sites you visit to use encrypted communications.

Cryptocat: just give the conversation a name and yourself a nickname. Anybody wanting to join just needs to know the conversation nickname.



and network taps from seeing what the site and your computer are saying to each other.

HTTPS Everywhere forces your connection to use HTTPS (instead of the unencrypted HTTP) on just about any site that supports it. More than 1,500 sites will be pushed to HTTPS automatically if you have the add-on running. On the downside, it can cause issues with some sites, so you may have to manually update the add-on's whitelist of sites that it won't activate on.

Another add-on privacy tool we really like is Disconnect (**disconnect.me**). It's an add-on for Firefox, Chrome and Safari that filters out tracking elements from web sites. The Facebook and Twitter widgets, analytics apps, tracking cookies and other page elements that can be used to track your online activity are filtered. Like HTTPS Everywhere, it tries to force HTTPS on sites that support it.

In addition to supporting HTTPS Everywhere, Disconnect and other security add-ons, Google's Chrome browser has another advantage: incognito tabs. Press Ctrl+Shift+N to open a new incognito tab and all new cookies created while that tab is open are deleted when it's closed (it also doesn't record browser or download histories in the tab). It doesn't prevent intercepts or the sites you visit from knowing your IP address, but it can help you avoid tracking cookies.

SEARCH

With Google's somewhat notorious data retention policies as well as it being named as a participant in the PRISM program, many users have gone looking for an alternative, anonymous search engine.

One option is DuckDuckGo (**duckduckgo.com**), which uses its own web crawler and combines search results with Google and Yahoo! search results. It keeps no records of searches, nor does it send your browser details or specific search terms to referred sites the way Google does.

Another option is Startpage (**startpage.com**), which straight up gives you Google Search results, but the search itself is anonymised. Google doesn't know who performed the search; instead, all results are relayed through the Startpage web service. Startpage itself keeps no records of search terms or IP addresses.

CHAT, VOLP & VIDEO

With Microsoft, Yahoo!, Facebook, Skype and Google all on the PRISM hitlist, it can be a little tricky to find a safe instant messaging client.

For pure IM chat, at the moment our pick is the open-source Pidgin

(**www.pidgin.im**) with the Off-the-Record Messaging add-on (**www.cypherpunks.ca/otr**). Pidgin itself isn't secure – it's primarily just a unified interface for accessing the many IM networks currently running around the world. But with the Off-the-Record Messaging add-on, which needs to be installed at both ends of an IM chat, chats are fully encrypted.

On the downside, Off-the-Record Messaging is quite challenging to set up, which is why we also like Cryptocat (**crypto.cat**), an add-on for Firefox, Chrome and Safari. Cryptocat lets you IM chat in your browser window, but uses the Off-the-Record Messaging protocol in the background to secure your conversation from eavesdroppers.

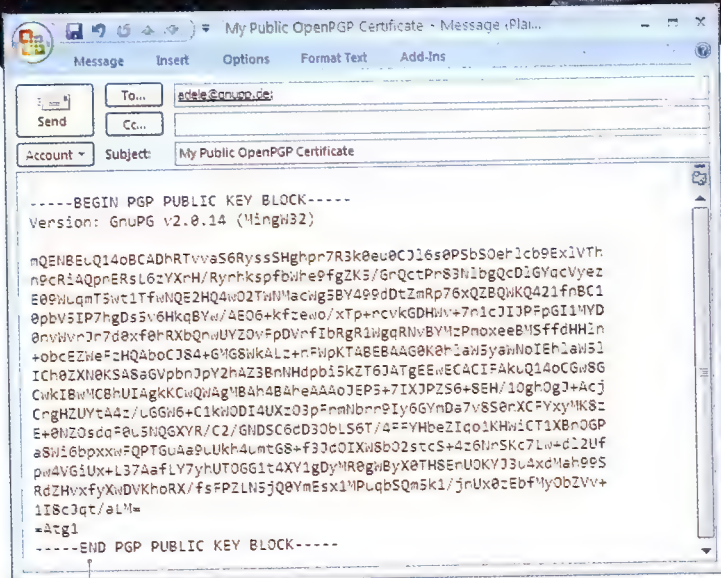
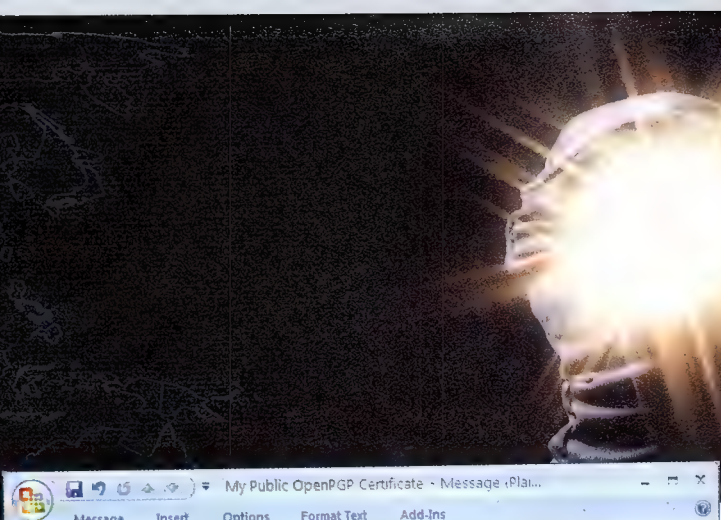
If you're looking for more than just chat, look no further than Jitsi (**jitsi.org**). It's an open-source, multi-platform application that does pretty much all the things that Skype does: instant messaging, video chat, voice chat and file transfer. It can piggyback off popular matching and presence services, like Google Talk, MSN Messenger and Facebook. But unlike Skype, Jitsi allows you to encrypt 1:1 communications. Video and voice calls can be encrypted with SDES, while instant messaging is encrypted using Off-the-Record Messaging encryption.

EMAIL

There are a number of tools for email encryption available. Unfortunately, most are quite difficult to use. The gold standard is probably GnuPG (**gnupg.org**), an open-source implementation of PGP (Pretty Good Privacy) encryption for email. The base tool is a command line

Jitsi allows fully encrypted multi-point video and voice calls.





PGP public key strings are seriously long.

application, so if you want something that's a little easier to use, you can try out Gpg4win (www.gpg4win.org), an implementation for Windows that comes with several Windows-based front ends as well as plug-ins for Outlook 2003 and 2007, and a (very basic) standalone mail client called Claws Mail, which has encryption built in.

Even with a graphical front end, though, PGP is a challenge to use. You first have to create a personal private/public encryption key pair – Gpg4win has a wizard that walks you through that process. The public key is a long string of random characters that can be attached to the card at the end of your email, or uploaded to a certificate server. Anybody who has your public key can then use it to encrypt emails before they send them to you.

Only someone with your private key (which is hopefully just you) can decrypt messages coded with your public key. When you get an email that's been encrypted with your key, you have to open the email (it will appear as gibberish because it's encrypted) in Gpg4win to be able to decode it.

Likewise, someone can send you their public key and Gpg4win has an app for managing the public keys of the people you know (this is called your keyring). To send them a secure email, you have to use Gpg4win to encrypt the body text of the email you're sending and then paste the output (again, which appears like gibberish) into the email client you use.

Obviously, this sounds like a lot of work for every email you want to encrypt. It does prevent network intercepts from reading the contents of your email, however, and creates a circle of trust – you know that only the person with the right private key can read the email you've encrypted with their public key.

If you find that Gpg4win is too much hard work, we really like Enigmail (www.enigmail.net) as an alternative. Enigmail uses the same PGP system as GnuPG/Gpg4win (and you need to install GnuPG beforehand, since it uses that in the back end), but it works as a plug-in for Mozilla's Thunderbird and makes encrypting emails and managing keys much easier. Once you set up your personal keys, encrypting an email you compose within Thunderbird is as simple as clicking on a button at the top of the window. It also has built-in hooks to public key servers, which

are places where you can publish your public key and get the published keys of other PGP users.

FILE ENCRYPTION

If you want to encrypt files in case your PC is lost or stolen, you can't really do better than TrueCrypt (www.truecrypt.org), a free open-source application that lets you create virtual drives onto which anything you copy will be encrypted. You can also encrypt entire drive partitions, even the system partition, since TrueCrypt has an optional preboot loader. TrueCrypt works entirely on the fly. Once it's installed, it's mostly transparent, apart from the need for passwords to access secure sections of your computer.

If you're more interested in protecting individual files – you might want to attach a file to an email or upload it to Dropbox and still have it safe from prying eyes – you can actually try using 7-Zip, a free and open-source compression tool. A ZIP compression tool might seem like a lightweight option for file protection, but it actually supports full AES-256 crypto.

PASSWORDS

Last, but certainly not least, we come to passwords. Username/password combinations remain one of the most common methods of security, yet it turns out that most passwords can be very quickly and easily guessed or brute-forced, especially now, using the massively parallel capabilities of modern programmable graphics cards.

Most web sites store their password lists in text files as cryptographically secure hashcodes. You can't reverse engineer the passwords by looking at a hashcode, but you can guess it and see if your guess is correct. In a report in May this year, Ars Technica pitted three top hackers against a list of 16,449 hashed passwords. The top hacker managed to crack more than 90% of them. Passwords less than six characters could be brute-forced in a matter of minutes simply by running every combination of characters against them. Dictionary words take even less time – a few seconds at most by running a dictionary attack on the code. Longer passwords are more difficult, but even complex passwords can sometimes be cracked.

Of course, remembering long strings of random numbers and letters isn't something the human brain is really built for. And we certainly can't remember a different one for every web site we visit.

This is where a password manager comes in. A password manager lets you secure your system and various web services with unique and strong passwords, but you only have to remember one master password, which should never be transmitted over the web and is only used locally for decryption. A good one will generate new passwords for you and these automatically-generated passwords should be close to uncrackable.

When it comes to free solutions, we really like LastPass (lastpass.com). It's really simple to use and supports automatic password generation on most major sites, password list synchronisation across multiple browsers and platforms, automatic form filling and even an onscreen keyboard to defeat keyloggers.

A little more barebones, KeePass (keepass.info) is another free solution that keeps a password vault protected by a master password. If you don't mind being a bit more hardcore about it, KeePass has a lot of advanced features to protect your password from prying eyes, including multi-user support, password groups and database transfers. We've included a complete how-to guide on getting up and running with KeePass on page 76. **adc**

SECURE YOUR PC, SMARTPHONE & TABLET

The traditional threats of viruses and hackers haven't gone anywhere. Nathan Taylor tests security suites for PC and mobiles.

Government spying programs may have hogged the headlines lately, but it's not like the other threats to your security and privacy have gone away. According to the most recent Microsoft Security Intelligence Report, the overall prevalence of threats and the number of computer infections remained steady and even increased a little in the last quarter of 2012. According to the report, nearly 35% of computers were infected with miscellaneous Trojans in that period and around 6% were infected with password stealers and monitoring tools. PC viruses are in no way a thing of the past.

And it's not just PCs that are in danger anymore. A report by ESET,

Trends for 2013, noted that in 2012 we saw an exponential growth in malware on mobile platforms. The amount of unique infection detections grew by 17 times globally in 2012 and that shows no signs of slowing down this year. Roughly 28% of mobile infections were spyware, 32% remote control (zombie) software and 40% automated diallers into premium SMS services. Given these numbers, it's definitely worth looking into commercial and free security solutions for all the computing platforms you use. This month, we've tested eight of the best PC suites available right now, as well as six of our favourite security systems available for your mobile or tablet.

AVG Internet Security 2013

A suite that has fully embraced Windows 8.

@ www.avg.com.au

\$ \$89.50 for three PCs for one year

✓ Flexible pricing, Windows 8-ified interface, very solid antivirus.

✗ Can be a little heavy on system resources.

8
10

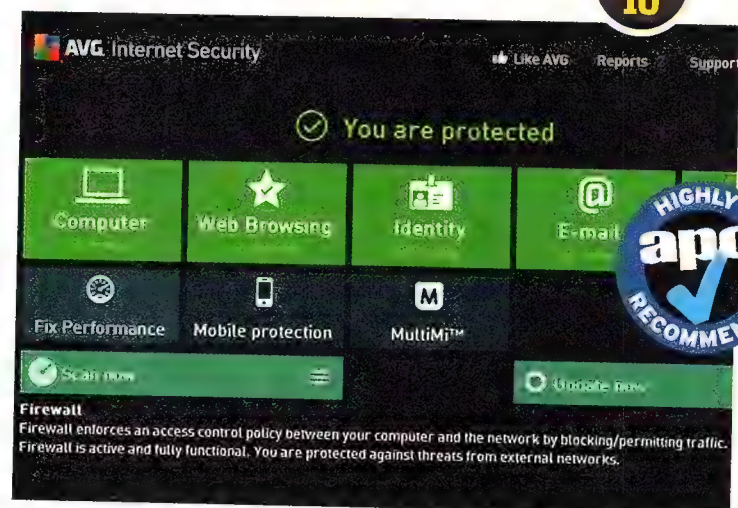
If there's one suite that looks like it belongs on Windows 8, it's AVG's Internet Security 2013. The suite received a major visual overhaul this year and now boasts big touch-friendly buttons and a definite Modern UI aesthetic. Of course, it still runs on earlier versions of Windows.

Like most other security suite providers, AVG has also done a lot of work to make it easier to use. Installation is a five-click operation (six or seven if you want to opt out of the browser toolbar and 'Safe Search') and the suite is mostly an install-and-forget affair.

It comes with the elements you'd expect: antimalware, firewall, antispam and also includes a host of other protections that operate in the background. It monitors IM file transfers on the major networks for infected files; checks email attachments; checks browser links for suspected scam and malware sites; and monitors and deletes third-party tracking cookies that it might detect. They're all solid features, although there's nothing here that really sets AVG apart from the other suites.

There is one unusual feature built into the suite, however: a 'Fix Performance' button and built-in AVG Accelerator that AVG alleges will significantly increase your download speeds for YouTube videos. The system tuning is the regular stuff, including scheduled drive defragging and registry cleanups, but the Accelerator piqued our interest. Unfortunately, it seemed to have no effect on our test system. YouTube videos worked just fine before and after the installation of AVG, with no noticeable difference in buffering speeds.

In the AV-TEST benchmarks, AVG Internet security turned in some



very solid results, showing that some good work has been done on the detection engine. It picked up 100% of zero-day exploits and had an up-to-date definition file covering 99% of the malware released in the four weeks prior to the test being run.



Bitdefender Internet Security 2013

The best suite on the market right now.

- @ www.bitdefender.com.au
- \$ \$104.95 for three computers for one year
- ✓ Near perfect antimalware, a tremendous feature set, light on system resources.
- ✗ None.

Bitdefender is a fully-fledged, consumer-friendly suite that's our current pick as the best security suite going right now. It aced both the zero-day and known malware tests, picking up 100% of viruses both known and unknown. It managed to do that without being overzealous – only in three instances did it give false-positive warnings about legitimate apps.

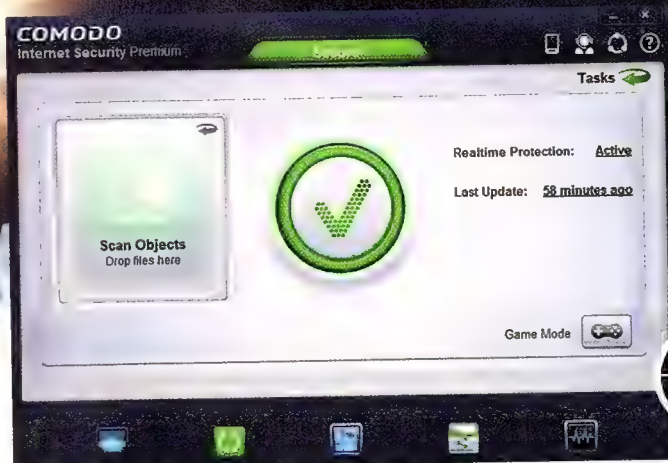
Even with its powerful defences, it proved to be light on system resources, with very little impact on the day-to-day operation of our test computer. According to AV-TEST, only Comodo was as good in this regard, and the Comodo suite doesn't have nearly as many features. Out of a perfect score of 18 across its three performance metrics, AV-TEST gave it a total score of 17.5 – only Kaspersky came even close to that.

What's more, Bitdefender has managed to find an excellent balance between customisation and simplicity. There's a 'User Mode' button that can be switched to 'Autopilot'; when this is on, Bitdefender makes all the decisions for you, without pop-ups or hassles. It's the definition of install and forget. However, if you switch off 'Autopilot', you have access to some of the most fine-grained controls in the business.

The interface is little changed from the 2012 version, which certainly isn't a bad thing. Modules such as firewall or antispam can be switched on and off quickly with a simple toggle, while clicking on a particular button will drill down into deeper settings.

In terms of the feature set, Bitdefender is very impressive. It has your usual standbys: firewall, antimalware, antispam and antiphishing. But there are some unique features here as well. There are tools to monitor and filter the online activities of your kids, for example, as well as remote management capabilities (awesome if you're the family go-to person for computer problems), a preboot recovery environment called 'Rescue Mode' and a new weekly security report. Perhaps most impressive is Bitdefender Safepay, a standalone sandboxed browser based on webkit designed to let you pay bills and perform other financial transactions online without fear of being hacked. It even comes with an onscreen keyboard to defeat keyloggers and automatic form filling through Bitdefender Wallet to expedite proceedings.

Bitdefender Internet Security is pretty much as good as it gets right now. It has the power we want in a suite without the hassle of having to deal with everything. We're not all that happy with the increase in price we've seen from previous years, but you can't argue with its quality.



Comodo Internet Security

A free suite that stands up against paid solutions when it comes to detection.

- @ www.comodo.com
- \$ Free
- ✓ Outstanding antimalware, it's free.
- ✗ Way too many false positives, not much more to the suite than antivirus and firewall.

A complete security suite that you can download for nothing is a rare thing indeed, but it's what you can get from Comodo. For something that's free, it certainly turned up some very good results in the AV-TEST benchmarks. It was one of a handful of suites to pick up 100% of zero-day viruses as well as known recent viruses. It also proved to be very light on system resources, rivalling Bitdefender on that score. What really let it down was its overzealousness – it detected a very high number of legitimate programs as threats during the AV-TEST benchmarks.

This was borne out during our testing. Comodo Internet Security has a sandboxing feature; when it detects a program as suspicious, it runs it in a sandbox that prevents the program from making any changes to the system. This is actually a pretty common feature of suites now, but the Comodo solution was much too eager to block apps. On three out of five apps we tried to install while the suite was running, it detected the installer as suspicious and sandboxed it, causing the installer to fail. We imagine that most likely people will turn this feature off, rendering it useless and reducing the protection afforded by the suite significantly.

Aside from antimalware and firewall features, the suite is more than a little barebones. It has some defences against malicious web sites in the form of Comodo's Secure DNS, which prevents domain name lookups of known malicious sites. We might have preferred some built-in heuristics as well to check individual pages on otherwise safe domains, but we suppose most browsers already have that covered these days anyway.

The interface is certainly better than Comodo's previous suites and navigating it shouldn't prove difficult for even neophyte users. In truth, though, there's not that much to navigate – while it's technically a suite, it's mostly just a bundled firewall and antivirus solution with a couple of odds and ends thrown in. The firewall isn't really markedly better than the one built into Windows, but the antimalware protection is... sort of. It clearly has excellent detection, but its overzealous nature will annoy and confuse a lot of inexperienced users.

For \$19.99 a year you can upgrade to Comodo Internet Security Pro 2013, which essentially gives you remote technical support and an unusual virus-free guarantee that says if the tech team can't get your system up and running again, you'll be insured for up to \$500. You can also purchase Comodo Internet Security Complete 2013 for \$39.99 a year, which adds on 10GB of online backup as well as data encryption over Wi-Fi.



F-Secure Internet Security 2013

A family-friendly suite with excellent protection.

- @ www.f-secure.com
- \$ \$88 for three computers for one year
- ✓ Excellent anti-malware protection, very simple interface, multi-user with solid parental controls.
- ✗ Anti-phishing and anti-spam are kind of weak.

F-Secure's antimalware has always been impressive. For years now its scanning engine has been at or near the top of the table when it comes to detection. We haven't always been that engaged by the suite's price or other features, however.

This time around it's different. F-Secure still doesn't have the feature set of the Bitdefender or Trend Micro suites, but it's very well-designed and supremely usable, especially in multiuser environments. Like most suites, it comes with malware protection, a firewall and antispam/phishing. There's also a web site filter that prevents you from visiting malicious sites and a very neat tool to elevate your browsing security settings when you visit your online banking site.

What has really impressed us in this release is the family-centric features. It has a well-designed multiuser interface, where each user logged onto the PC has unique security settings. This works with the excellent parental controls, which can be used to both limit application access times as well as block web sites based on filtering categories. It would have been better if the parental controls were completely browser independent, but it's still better than most solutions.

The core protection provided is still there. Out of 26 suites tested by AV-TEST in June, only six scored 100/100 on malware detection and F-Secure was one of those. It did turn up a few false positives and had a moderate effect on system performance, but certainly nothing major. If there's a weakness here it's in the spam and phishing control – you might find yourself better served by the default IE/Firefox/Chrome/Outlook capabilities. Aside from that, it's certainly worth a look.



Kaspersky PURE 3.0

Much more than just antimalware.

- @ www.kaspersky.com.au
- \$ \$129.95 for three PCs for one year
- ✓ Has every tool and utility you could ever need, outstanding virus protection
- ✗ Perhaps a little overstuffed with features, making management of the suite a little scary.

In ages past, it felt like the Kaspersky suite was really just a wrapper for Kaspersky antivirus. Now, things are quite different. Kaspersky PURE is a comprehensive suite to rival the best of them.

Testing Kaspersky Internet Security 2013 (which uses the same AV engine as PURE), AV-TEST gave it perfect detection scores. It hit few false positives and had only a moderate impact on system performance. In total, its overall score from AV-TEST was second only to Bitdefender.

The rest of the PURE suite is also impressive. There are a comprehensive set of tools here, from antiphishing to antispam to some very solid parental controls. This latest version of the suite has also added (as has become something of a trend) hardening of security during online transactions. Called Safe Money, you activate it in your browser when you're performing a netbank transaction (which causes a green border around the window to appear) and the suite will then block external apps from monitoring your keystrokes as well as verify the digital certificates and web site against a whitelist of known safe sites.

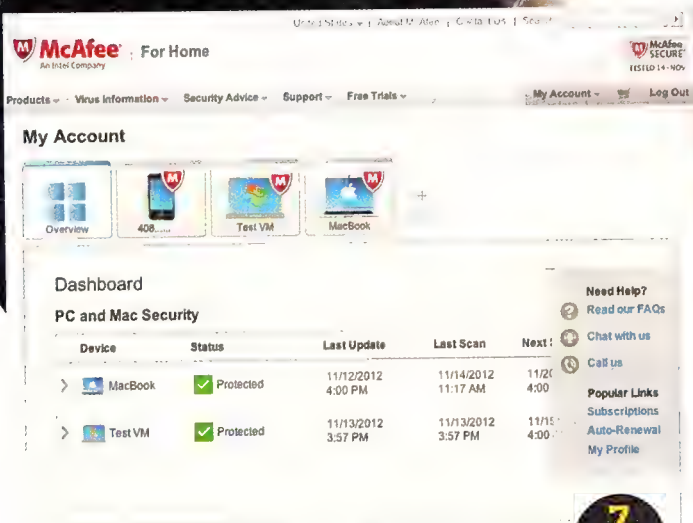
There are a host of other features we like in the suite as well. Remote management of multiple PCs attached to a single licence is great, and it's one of the few suites to come with an inbuilt password manager (and a good one, too) that can store and generate secure passwords for the web sites you use. There's also online ad-blocking, a file shredder and system cleaner, low-power mode for laptops, a decent backup system that will work with Dropbox as well as locally, a preboot recovery environment and more built into the suite. In short, it's the complete package and while it's a little pricey for a three-PC licence, Kaspersky does give you the option of buying a single PC licence for just \$64.95 per year.

WHAT THE TEST SCORES MEAN

The test scores in the table on page 71 are the product of an extensive set of tests run in June 2013 by the AV-TEST Institute. You can find a full set of results on its site at av-test.org, including results for more than 15 products not reviewed here. AV-TEST grades antimalware solutions on three metrics:

protection, performance and usability. Protection is the product of two tests: a zero-day test that pits it against a suite of new viruses for which definitions haven't yet been written. This gives a measure of the heuristic detection afforded by the suite. The second test pits it against a suite of thousands of

known viruses released in the month prior to the test, showing how responsive the company behind the product is at getting out new virus definitions. Performance is a measure of experienced slowdowns relative to a system without the software installed. Performance tests are run for everyday activities with and



McAfee All Access 2013

A suite with features galore.

@ www.mcafee.com.au

\$ \$149.95 for one user (but unlimited devices)

✓ Lots and lots of features, multi-platform so it covers all your devices.

✗ Ugly and inaccessible management interface, noticeably slows your PC down.

The latest bundle from McAfee, All Access is more than a little bloated with capabilities and McAfee hasn't quite figured out how to provide a lot of features while still making a suite simple and accessible. The uninspiring interface has separate modules for just about everything it does and managing them all could be a little overwhelming.

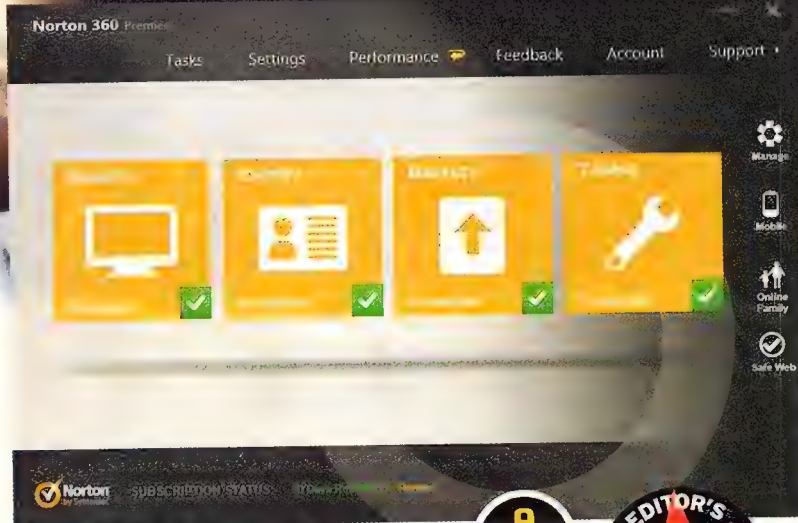
You get a lot of stuff for your money, however. Antimalware, antispyware, web site and phishing security, parental controls, identity theft defence, social networking protection, system cleanup and optimisation and a new password manager called SafeKey are just the beginning. Its strongest feature is probably its parental controls, which include web site filters as well as comprehensive activity logs and lockout schedules. The new password manager is OK and better than the nothing that most people use, but we'd suggest LastPass (lastpass.com) as a better solution.

The 'All Access' comes from the unusual licensing model. It's for a single user only, but it can be installed on all the devices you own, including multiple PCs and Macs as well as Android mobiles. The mobile version includes both antimalware as well as antitheft mechanisms including remote lock, backup, locate and wipe. We installed the suite on Android and really liked the simplicity of the interface (much more than the desktop interface), and the location and remote wipe features are well implemented. SMS and call blocking are also welcome additions.

When it comes to the core functionality – protection from malicious software – McAfee performed more than well enough in AV-TEST's benchmarks. It was particularly clean, producing very few false positives, but proved to be a major drain on system resources when running. If you're worried about diminished performance, this isn't the suite for you.

without the antimalware installed. Usability is based on the number and type of false positives produced. Every time a security solution blocks a legitimate program, it's a pain for the user and a black mark against it in terms of usability. Note that usability

on this scale is a measurement purely of false positives and not a subjective rating of the interface of the suite. For each metric, a rating between zero and six is given to each suite, as well as an aggregate score that's simply the sum of all three scores.



Norton 360

Still the most elegant suite on the market.

@ www.symantec.com.au

\$ \$89.99 for three PCs for one year

✓ An elegant system, excellent backup and system tune-up built in, along with system recovery tools.

✗ Starting to get a little left behind by Kaspersky and Bitdefender in anti-malware.

First released in 2007, Norton 360 was a revolution for both Symantec and security software in general. Instead of a high-maintenance mess, we had a sleek tool that kept a system tuned and safe with barely any user input.

In the six years since, Symantec has really refined that formula, producing the sleekest, most usable suite on the market that now features a touch-friendly interface and a high level of automation. It may not have the raw power and capabilities that a tool like Bitdefender Total Security or Kaspersky PURE has, but if you're looking for an install-and-forget solution, we still love the simplicity and elegance of Norton 360.

In terms of features, it has your core elements, of course: firewall, antimalware and antispyware. It will also detect and stop you from visiting malicious web sites and verifies banking and shopping sites. There's a system tune-up, which clears your Windows registry and defrags your hard drive, along with an excellent recovery system that will restore your system without needing to boot into Windows. That recovery system works very well with Norton's backup system, which has particularly excellent full system backup tools borrowed from Norton's own Ghost. The regular version of the suite also comes with 2GB of online backup, which isn't that compelling, since you can get that for free from many services.

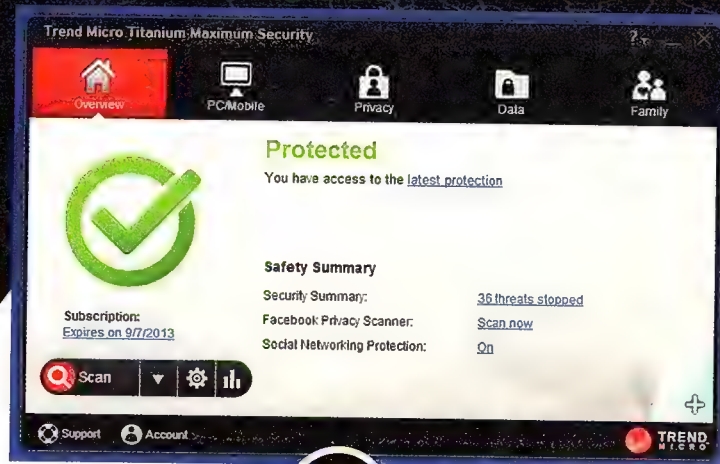
Parental controls, once one of the shakiest parts of Norton 360, are also present in this new version and they're quite decent, allowing you to monitor your children's online activities, set time limits and restrict certain access to sites. Like much of the suite, it's not flashy – it sits quietly in the background and does its thing.

As we've come to expect from Symantec, the suite's antimalware performance was very good. It missed 3% of zero-day attacks, but it had very few false positives. AV-TEST did find that it reduced system performance by a notable amount, which makes it clear that Symantec still has a little bit of work to do in that area to catch up to the likes of Bitdefender.

There are also other versions of the program available for purchase. Norton 360 Premier Edition costs \$10 more per year and provides 25GB of online backup. There's also Norton Internet Security for \$69.99 for three PCs for one year, which has most of the features of 360, although it lacks any kind of backup.

Trend Micro Titanium Maximum Security 2013

A suite with a big focus on social networking and parental controls.



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@ www.trendmicro.com.au

✓ A ton of features, rivaling even Kaspersky PURE, substantial online storage.

\$ \$129.95 for five PCs for one year

✗ Too much work to configure and manage.

As with the Kaspersky and McAfee products, there aren't many system security checkboxes that Trend Micro can't tick on the specification sheet. Malware, spam, firewall? Of course. Parental controls and protection for malicious web sites? Sure. System tuning, online backup, password manager and secure document vaults? Yep, yep, yep and yep.

The real question is does it really add up to something truly useful or is Trend Micro just spamming us with features? To a certain extent, it feels like the latter. That's not to say that the individual elements aren't good. The parental controls are strong, the password manager is basic yet useful, and we can certainly see the value of its extensive and unique social networking defences as well as its mobile syncing tools. Being able to create secure encrypted folders is nifty as well, as is the remote locking and wiping of data on a lost or stolen device.

But Trend Micro hasn't quite figured out how to make it into a cohesive whole. The interface is highly modularised and uses one of our big bugbears: security sliders (should I not always set it to maximum security?). In contrast to Norton 360, which just works and doesn't make a thing of telling you how, or Bitdefender in 'Autopilot' mode, you feel like you have to work a little to set up Trend Micro. Of course, some people don't mind that at all and will appreciate all the capabilities it offers in Titanium Maximum Security. They'll also appreciate its powerful antivirus capabilities, with the suite picking up 98% of zero-day viruses and 100% of recent known viruses in the AV-TEST benchmarks. There were very few false positives, but AV-TEST did note a relatively high amount of system resources being used by the suite.

Trend Micro also offers the Internet Security 2013 suite (\$99.95 for three PCs for one year), which doesn't have online backup or online banking protections. Premium Security (\$169.95 for five PCs for one year) has everything that Maximum Security does and bumps online storage from 10GB to 25GB.

THE BEST SECURITY APPS FOR YOUR MOBILE

Mobile phone security has come a long way in just the past year or two. Once used only by the extremely paranoid, mobile phone security apps have become more popular as the range of threats targeting smartphones has increased. Nearly every vendor of desktop security solutions also has at least one mobile solution available now and they're worth investigating. We'd suggest trying the free ones first, in case you find that the effect on your phone's battery life or performance is unacceptable; for the most part, though, the solutions have gotten better in both these areas. This month we also tested a range of mobile security tools to uncover which ones make the cut.



avast! Free Mobile Security

\$ Free @ www.avast.com/free-mobile-security

Like AVG opposite, avast! is one of the major security software vendors that has ported its software to Android and then decided to make it completely free. It's not just the antivirus that you get: there's a call and SMS blocker, filtering of malicious web sites, tracking of 3G and Wi-Fi data usage and all the usual anti-theft mechanisms, including remote lock wipe, SIM card removal detection and GPS locator. It also has an inbuilt two-way firewall, although that will only be available on rooted phones since it needs access to the network stack. It's all managed through a very simple interface that works for both phone and tablet-sized devices. An Android widget can be embedded in the desktop to provide live security status and quick access to the app. All in all, it's an app we'd gladly pay for – but we don't have to.

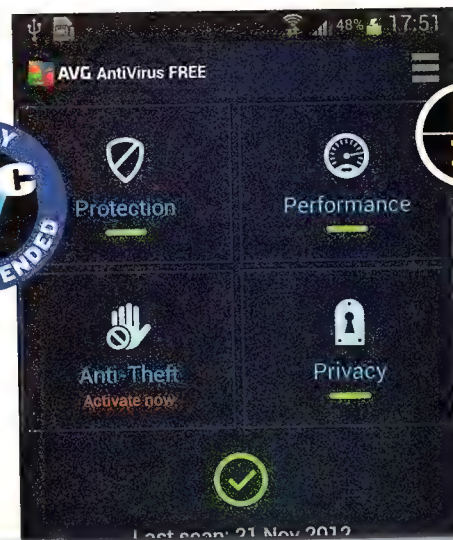
AV-TEST JUNE TEST RESULTS

Vendor	AVG	Bitdefender	Comodo	F-Secure	Kaspersky Lab	McAfee	Symantec	Trend Micro
Product	Internet Security 2013	Internet Security 2013	Internet Security	Internet Security 2013	PURE 3.0	All Access 2013	Norton 360	Titanium Maximum Security 2013
Web site	www.avg.com	www.bitdefender.com	www.comodo.com	www.f-secure.com	www.kaspersky.com	www.mcafee.com	www.symantec.com	www.trendmicro.com
Protection against zero-day malware attacks	100%	100%	100%	100%	100%	97%	97%	98%
Detection of new malware discovered in the last month	99%	100%	100%	100%	100%	100%	100%	100%
Impact on PC performance (lower is better)	6	2	2	5	4	10	7	7
False warnings or blockages when visiting web sites	0	0	0	0	0	0	0	0
False detections of legitimate software as malware	4	3	13	4	3	0	2	1
False blockages installing and using legitimate software	0	0	2	1	0	1	0	2
AV-TEST protection score (out of 6)	5.0	6.0	6.0	6.0	6.0	5.5	5.5	5.5
AV-TEST performance score (out of 6)	3.5	5.5	5.5	4.0	4.5	3.0	3.5	3.5
AV-TEST usability score (out of 6)	5.5	6.0	3.5	5.5	6.0	6.0	6.0	5.5
Total points (out of 18)	14.0	17.5	15.0	15.5	16.5	14.5	15.0	14.5

AVG Antivirus for Android

\$ Free @ www.avg.com.au

For a product that's absolutely free, AVG Antivirus for Android does an awful lot. Not only does it have an active virus scanner for your apps and files stored on the phone, it also includes a really nifty little suite of other tools. The task killer and SMS filter are neat, and the web page malware and scam detection provides desktop-like protection on your mobile. Perhaps most impressive of all is the inclusion of some really cool anti-theft tools in the form of AVG Mobilation, which provides GPS/Google Maps tracking of a lost or stolen phone, remote locking via SMS (with a customisable lock screen that you can put your contact details into to help people get your phone back to you), as well as a remote wipe. And it's all managed through a simple, intuitive and non-intrusive interface.



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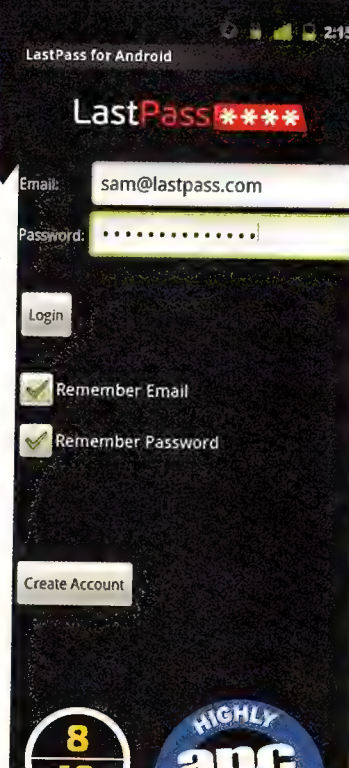


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F-Secure Mobile Security for Android and Symbian

\$ \$22 for one device for one year **@** mobile.f-secure.com

In its way, F-Secure's Mobile Security is more impressive than its desktop counterpart. Sure, it's not free like the AVG or avast!'s solution (in fact, you'd be hard pressed to find a more expensive mobile product), but it's an elegant solution that offer theft and malware security, as well as (somewhat uniquely) parental controls. Its anti-theft features include remote SMS phone locking, remote wipe, GPS tracking and perhaps most amusingly, the ability to make the phone emit an alarm sound as loud as its speakers will go. It can also be configured to lock the phone if the SIM is removed. For parental controls there's both list-based web site filtering and location monitoring.



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LastPass Premium

\$ US\$12 per year **@** www.lastpass.com

LastPass is an excellent password manager, capable of automatically generating and storing strong and unique passwords for the many sites you visit. One of its great features is the ability to sync your password list and autofill form details across multiple devices – including mobile devices. To do that, you'll need LastPass premium, available for US\$12 per year. With Premium, you can sync your password list to iOS, Android, BlackBerry, Windows Phone, Symbian and even webOS devices. It will work with mobile versions of Firefox, Chrome and Dolphin. Initial setup on a mobile can be a little painful, since you have to fill in a lot of details and then save them, but if you use LastPass on your desktop, the mobile version is a must-have.



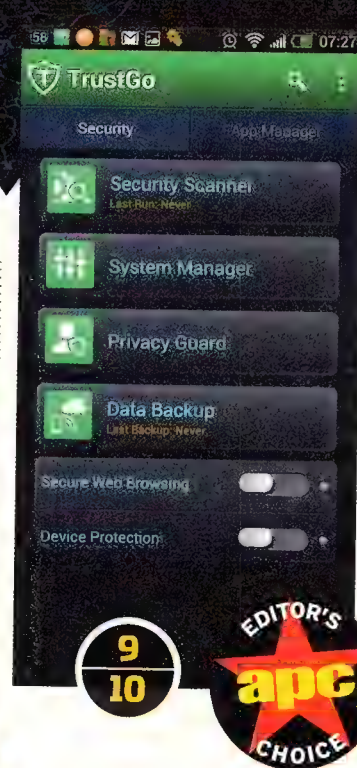
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Lookout

\$ Free **@** www.lookout.com

Like TrustGo and AVG, Lookout provides what is essentially a complete security suite for your Android mobile entirely for free. What's more, it has a markedly more elegant interface than TrustGo, although it's not quite as feature-rich. At base level, it provides real-time and scheduled scans of apps on your system for known malware. It has a privacy advisor as well, which checks the permissions of your apps and warns you of anything suspicious. It will stop you from visiting malicious or known scam sites in your web browser, and there's also cloud backup of your contacts and photos, which can be copied to a new device if you like. Lookout features an array of anti-theft mechanisms including remote lock, wipe and locate, too. We also particularly like Signal Flare, which saves your phone's location to the cloud when the battery gets low, so you can recover a lost phone even if the battery dies.



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TrustGo Antivirus & Mobile Security

\$ Free **@** www.trustgo.com

TrustGo was one of the earlier pioneers of mobile security and that experience shows. It has a range of tools to protect your Android smartphone: a scheduled, real-time and manual virus scanner; blocking of malicious web sites; a quick system manager; remote alarm; and wipe and lock anti-theft mechanisms. There are also some tools built in that we've seen almost nowhere else. We particularly like the Secure App Finder Engine. It allows you to search for new apps, just like you can in Google Play, but only results that have been tested and certified virus-free will appear. The cloud backup system is also top-notch, including contacts, SMS history and call logs. Its interface is a little on the ugly and clunky side, but it's hard to argue against the capabilities of TrustGo, especially when it's available for free. **APC**

TECH AUSTRALIA life



*On sale now for
only \$6.49*



iPad is a trademark of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc.

DOES YOUR MAC NEED PROTECTION?

Mac OS X was once a utopia of virus- and threat-free computing, where users had nothing to fear from the nasties of the Windows world — or was it? And can it ever be? Matthew J.C. Powell explains.

Historically, there have been far fewer viruses and other malware attacks on Macs than there have been on Windows. Malware authors, like other developers, go for the biggest audience. Whether the aim was just to show off, to cause damage or to make money, the big target was (and still is) Windows.

In recent times, though, the Mac has gained market share. That makes it a more attractive target. What's more, Mac users arguably haven't been battle-hardened from years of constant attack the way Windows users have — frankly, the 'invulnerability' of the Mac has led to complacency. So the Mac user base is now a bigger target than it was and potentially a softer one.

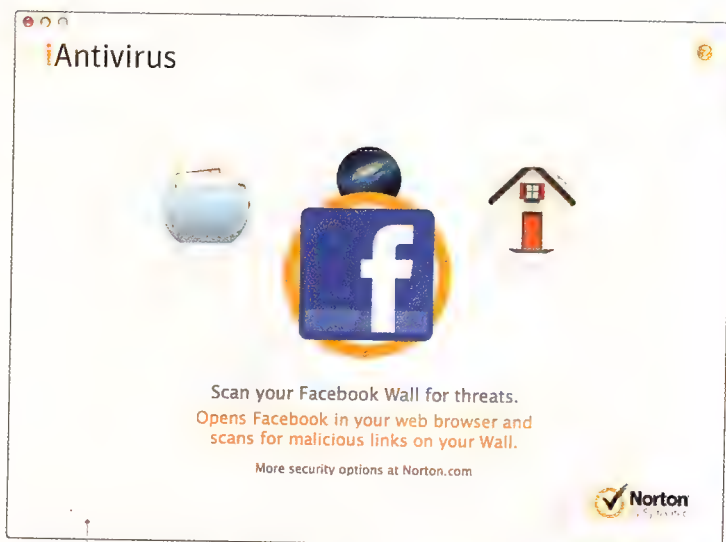
Apple itself was a victim of this complacency. One of the highly-regarded 'I'm a Mac' ads featured Mac guy telling PC guy, "I'm immune to your viruses," subtly implying that the Mac was immune to all viruses. It wasn't — no computer is. What's more, the lack of security attacks on the Mac platform meant that Apple was slower to build certain security features into its OS and web browser. In many ways, OS X was a less secure system than Windows, but no-one realised because the enemy wasn't at the gates.

The enemy is here now. While once it could be said that security software on a Mac was an optional extra — to be installed if you were

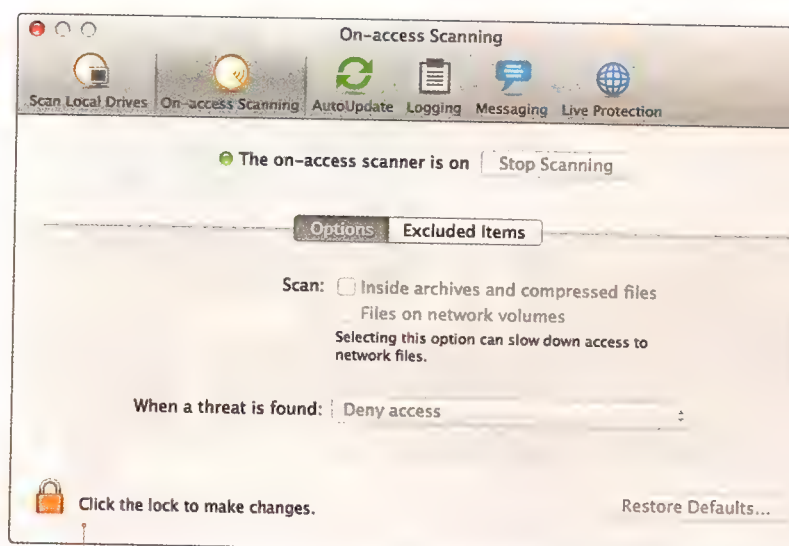
overly cautious or wanted to be a 'good citizen' — it is far less so now. Both Mac-specific malware, such as the Mac Defender Trojan and the Flashfake botnet that targeted OS X, and platform-agnostic malware are on the rise.

Kaspersky Labs recorded a 600% increase in the detection of Mac malware signatures between 2010 and 2012. The raw numbers are still minuscule compared to the number of attacks targeting Windows machines — dozens versus hundreds of thousands — but they're clearly on the rise. Barring an unexpected change in the trajectory of Apple's market share, that's not likely to change. The 'good citizen' argument still holds as well. Basically, even if malware written for Windows won't affect your Mac, an infected document that you receive on your Mac and then send to a Windows-using colleague can do damage to their computer and your reputation.

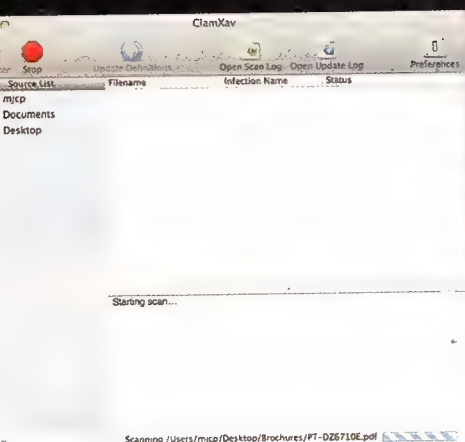
Apple has beefed up security features in successive versions of OS X and it's now a much tougher target than it was. For instance, applications run in randomised memory locations, making it harder for malicious software to attack them. Many applications are also sandboxed, which means they run in their own protected bit of memory and can't affect the rest of the system — even if there's a compromise, the damage is limited. And of course, Gatekeeper (introduced in Mountain Lion) allows you to



Symantec's iAntivirus features anti-phishing tools as well as on-demand AV, just like its pricey cousin, Norton Internet Security.



Sophos Antivirus for Mac Home Edition is the only free tool that runs in the background, updates itself automatically and scans for Mac and Windows malware — definitely your best bet in the unpaid options.



ClamXAV has always been designed for Mac users with fairly basic AV requirements, which is most of us, right?

limit the software that can be installed on your Mac. At its strictest setting, only software that has come from the App Store and been vetted by Apple will be installed, reducing the likelihood of nasties.

Even so, it pays to protect yourself and your online reputation with additional third-party software. Thankfully, good options can be had for very little investment.

FREE ANTIVIRUS OPTIONS

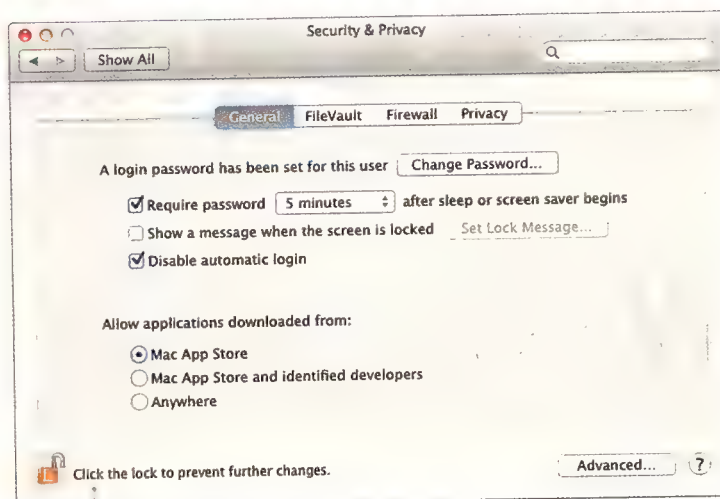
There are actually several good-quality antimalware applications available for no cost whatsoever. They obviously feature a simpler feature set than their paid counterparts, but are generally adequate to boost your Mac's security beyond its inbuilt basics.

ClamXAV (tinyurl.com/mgbrjtc) is the best-known of the free AV tools and has been an arrow in the security-conscious Mac user's quiver for many years. Its interface is a bit dated compared to some, but it can spot Windows malware as well as Mac-specific attacks. Like most of the free tools, it can be run manually or on a schedule and it can scan your entire drive or just selected locations. You can also drag and drop suspect files to have it check them out. Unfortunately, it doesn't actually repair infected files, so you have the choice to trash them or quarantine them for repair by another tool.

VirusBarrier Express by Intego (tinyurl.com/k5ldg9k) is a free version of the company's much more powerful VirusBarrier Plus, which is also available from the Mac App Store. It has a more modern interface than ClamXAV, but a similar feature set: scan selected areas or the whole drive, run scans manually or to a schedule, and drag suspect files to scan them (also adds a contextual menu so you can right-click on a suspect file without having to open the app). Its big advantage over ClamXAV is that it has the ability to repair most infected files. Where it falls down is that the Express version only scans for Mac malware – scanning for Windows malware ought to be a minimum requirement for this type of application.

iAntivirus by Symantec (tinyurl.com/kkcrsfe) adds the ability to scan your Facebook Wall to protect against scams, malicious downloads and phishing attacks. Safari already does that to some extent, but iAntivirus has more sophisticated tools for doing so and is a complement to Safari's features. Like the other free AV tools in the App Store it's on demand, so it scans for viruses when you tell it to either manually or on a schedule. Like VirusBarrier Express, it has the ability to repair infected files, not merely quarantine them. However, it can also recognise and repair Windows malware, making it the better bet.

Sophos Antivirus for Mac (tinyurl.com/SophosMacAV) deserves a mention because it's an excellent free AV tool. Of the free tools, it's the only one that runs in the background and includes on-access scanning, so it looks at everything that arrives on your computer – whether by email, the web or other – and scans it before it has a chance to do anything. It's the only free AV tool we'd recommend that isn't available from the App Store, so if you've set your Mac's security features to the max, you'll have to lower the drawbridge and tell Gatekeeper to let it in. It optionally maintains a live link to SophosLabs for its definitions, so you'll have to adjust your firewall to keep it functioning at its best.



OS X Mountain Lion (and later) includes a feature called Gatekeeper, which prevents software from installing or running on your computer unless you specifically allow it.



Recent versions of Safari include the ability to notify you if a web site you attempt to access is suspicious – either a phishing scam or potential source of malware.

PAID MAC ANTIVIRUS SOFTWARE

Given the power of the free tools available, you may not feel the need to pay for Mac AV protection. If you do, though, you gain some advantages.

VirusBarrier Plus by Intego (tinyurl.com/m98omq3) is \$10.49 and adds recognition of Windows and Linux malware over the free version, as well as the ability to repair more types of files including PDFs. It also detects malware embedded in Java and Flash, which have been the primary vectors for a number of Mac infections. Like its free brother, it remains an on-demand tool. If you want an Intego AV solution that runs in the background, scanning email and incoming traffic, you need Intego's US\$49.99 Mac Internet Security 2013 (tinyurl.com/7q6xvcz).

Norton AntiVirus for Mac (tinyurl.com/mfdzxm) costs \$60 and runs in the background, so you don't have to think about it. It also intelligently schedules its definition updates to minimise their impact on your Mac's performance. Norton also sells Internet Security 5 for Mac (\$80), which includes the AV protection plus anti-phishing tools and various other security goodies such as a two-way firewall (the Mac's inbuilt firewalls only monitor incoming traffic, not outgoing). **ATC**

PROPER PASSWORD ANAGEMENT

A password manager can dramatically increase your online security and safety, as well as make life easier. Simon Chester explains.

We all have so many passwords in our life that using them is often viewed more as an inconvenience than necessary security practice. And because typing in and remembering a long, secure password is much harder than a short, simple one, most people follow the path of least resistance and use their dog's name followed by their house number. Worst. Idea. Ever.

In the last three months alone, we've had friends have their email and Facebook account accessed by someone in another country. These attacks were possible because of poor password practices. In one case, they used a password that was easy to guess and in the other, they used the same password for all their sites and had used it for many years. Some forgotten online account's database was likely compromised by an attacker and when your username on that service is your email address, it's then trivial for the attacker to gain access to your entire digital life.

It's therefore imperative that you use strong, random (or pseudo-random) passwords that are unique to each account you are registered to. Of course, this isn't possible if you're relying on your brain to remember them all, so it's therefore equally as imperative that you use a password manager to keep track of them all.

CHOOSING A PASSWORD MANAGER

Thankfully, password managers offer features that go beyond just providing a place to store your passwords – most can automatically log you into sites, which makes highly secure passwords easier to enter than even your mother's woefully weak 'daisy123'.

They also offer you a secure location to store information other than passwords, too, including bank account details and PINs, Bitcoin wallet

addresses, email and other configuration settings, encryption keys, client details and some even allow you to include photos and other files, although the interfaces aren't really optimised for browsing image libraries.

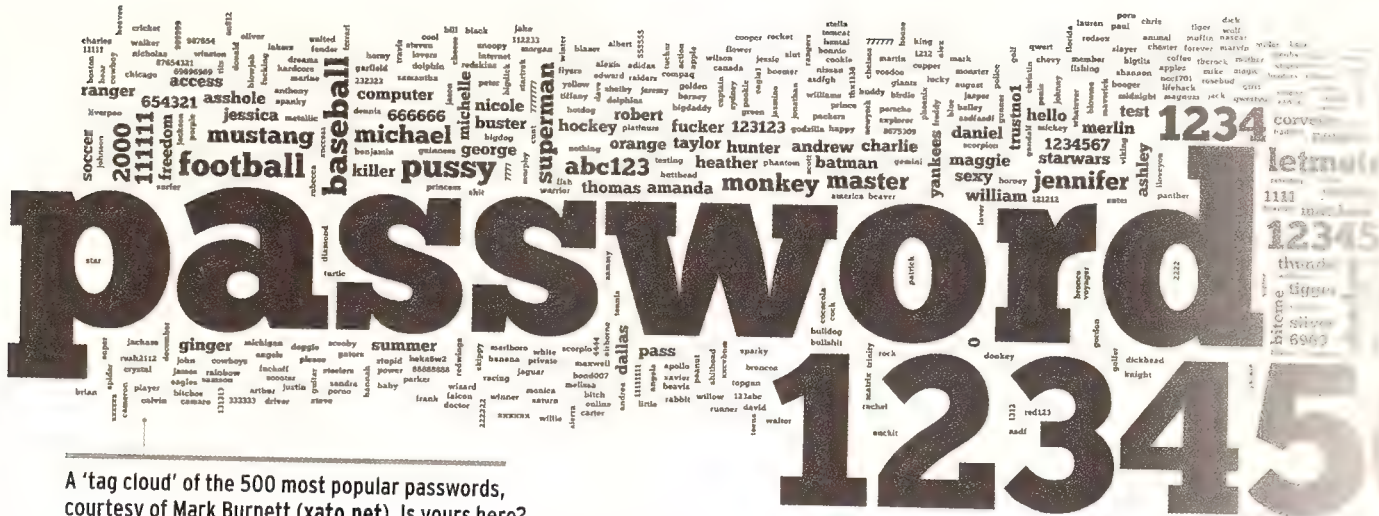
There's a great number of competing password managers out there, with different features, interfaces and platform compatibility. Popular vendor examples include: LastPass, 1Password, SplashID and RoboForm. Some of these are freemium, while most are paid. Alternatively, there are the open-source KeePass and Password Safe.

We're big fans of the open-source movement and because there are ports available for pretty much every platform ever, our password manager of choice is KeePass, available for free from keepass.info. So, for the remainder of this guide, we'll use it as the example.

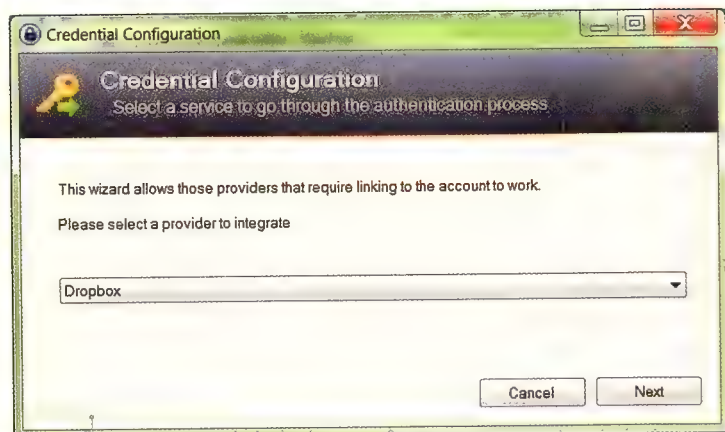
HOW DO THEY WORK?

Password managers keep your passwords stored in an encrypted database – a single file that you can store anywhere, from an external drive to your Dropbox. As this file is encrypted using a password of your choosing, this password becomes the chink in your digital armour. It's therefore absolutely critical that you create a strong one (see the 'Database password' box on page 77). This is the only password you'll ever have to remember again, so you can afford to dedicate the time to memorising a string that may otherwise be a little difficult to remember.

The KeePass 2.x database allows you to store fields of any type or name of your choosing, including binary objects, and you can organise your entries by category (for example, 'Internet' or 'Banking'). The software also includes a random password generator, optional reminders



A 'tag cloud' of the 500 most popular passwords, courtesy of Mark Burnett (xato.net). Is yours here?



You can set up KeePass to open your database directly from Dropbox.

to change older passwords, multiple simultaneous users and more. It even supports plug-ins to extend this already rich feature set.

WHAT CAN YOU DO WITH THEM?

A password manager is only as good as its accessibility – if you can't use it at a time when you need to enter a password then it has failed. So you not only need to have the same program (or a compatible equivalent) running on every platform/device that you use, you also need that copy to be able to access the same database. The easiest way to do this is to sync that database to the cloud.

LastPass and others offer this functionality natively, but it's just as easy to do with KeePass by saving the database somewhere in your Dropbox folder.

But wait, isn't this a security risk? In truth, it is. However, your database is encrypted, so because you used a strong password to encrypt it, it can't actually be read by anyone that gets their hands on a copy. Additionally, the files stored on your Dropbox are also encrypted, so they can't be read by anyone else (except maybe the NSA – unfortunately, Mr Snowden wasn't available for comment at the time of writing).

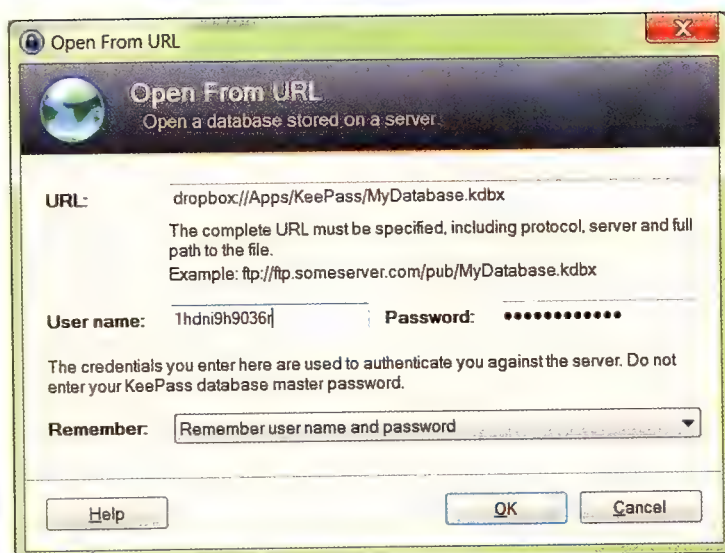
PORTABLE POWER

KeePass doesn't have to be installed on the computer that you're accessing it from – it can also be run directly from a USB flash or external hard drive. When you first downloaded it, you could choose between the EXE version or a ZIP version. To make it a portable installation, simply extract the ZIP version onto your external drive. Users of the **PortableApps.com** platform can install a native KeePass version; however, we couldn't get plug-ins to work with it (YMMV). To work around this, we simply extracted the ZIP version into its own folder in the \PortableApps\ directory. It even appears in the 'PortableApps' menu, like the other apps.

If you're running a portable password manager, chances are that you're not on a PC that has the Dropbox sync software installed (for example, at work or a library). Thankfully, there's a KeePass plug-in available that will read from and write to Dropbox directly. It's called KeeCloud and it's available from tinyurl.com/leb9sp4. To set it up,

DATABASE PASSWORD

In picking a password to encrypt your password database with, you'll need one that's simultaneously memorable *and* super strong. The best way to achieve this is to string together four or more random words (the generator at tinyurl.com/43b8nn5 will do this for you and provide you with a relevant xkcd comic, too). Then, make some letters upper case, substitute some for numbers and throw in a few symbols for good measure. It's a lot easier to remember 'l4uNderIngs#aGgyj3rkinrackIng' (laundering snaggy jerkin racking) than it is 'QMqlcxMd*1u9\$@6kDvbRtW?hVVoTd', while the difference in hackability is quite small.



Your 'Master Key' is the chink in your digital armour. Choose it wisely.

download the install file, place 'KeeCloud.plgx' in the KeePass directory and restart KeePass.

You have two options to sync your database: either by opening it from and saving it directly to Dropbox, which will be suitable for most users, or using KeePass's inbuilt synchronisation system to sync any changes to Dropbox while working from a locally stored copy (this is a better setup if multiple people/computers are accessing the database). You can get an overview of the two methods at tinyurl.com/l9tojes, but we'll focus on the former here.

First of all, we're assuming that you've already saved your database to Dropbox, likely from your main PC's installation, as this usage only really applies to secondary copies. Within KeePass (it doesn't matter if your database is open or not), go to 'Tools > URL Credential Wizard' and select the service you wish to configure (for example, Dropbox) and hit 'Next'. A browser window will open, where you'll log into Dropbox and approve the app. Once you have, go back to the wizard and hit 'Next' again.

You'll then be shown the username and password to use when accessing the database stored in Dropbox. Note them down (if your

FURTHER READING

Want to learn more about password security? Try the following articles.

- tinyurl.com/moy57e: This site talks about the 500 most common passwords, which at least one in nine people use.
- tinyurl.com/5u53r5u: Troy Hunt investigates what makes us choose the passwords we choose.
- tinyurl.com/cf6neq9: Offers a fascinating insight into just how people crack passwords, how easy it has become and how to pick a good password.

database was already open, it'll give you the option to save it there).

Next you'll want to open the file from your Dropbox URL directly, using the credentials you just noted down. Click 'File > Open > Open URL' and enter the directory in Dropbox where you saved your database, prepended with **dropbox://** (**dropbox://Apps/KeePass/MyDatabase.kdbx**, for instance). In the fields below that, enter the username and password returned by your credentials manager, and then set the drop-down menu to remember both your username and password.

From now on, when you open the KeePass app on your USB drive, you'll notice on the 'Enter Master Key' dialogue box that it's accessing your Dropbox directly. If you modify anything and hit 'Save', it will then save it directly to your Dropbox and propagate that file to all your Dropbox clients. If you should run into problems, you can read the configuration guide at tinyurl.com/mz8op4b.

I DON'T TRUST THE CLOUD

If you're irked by the cloud and need to use KeePass on multiple PCs, you can always carry your database around on the USB flash drive that also holds a copy of KeePass Portable, and just copy it over manually whenever you update it, or you can alternatively use KeePass's built-in synchronisation tools.

If you modify your USB version and want to sync the changes to the copy you have on your home or work PC, simply plug in your USB drive, open your local copy of KeePass, go to 'File > Synchronize > Synchronize with File' and choose the database on your USB drive. The changes you made while out and about will then appear in your local database.

Alternatively, for a really portable version – the kind where you don't even need to carry around physical media – you can run a web-based version of KeePass from your home PC, which can be accessed from

almost any browser, including Apple Safari, and supports multiple simultaneous users. There's a thorough how-to guide in the installation ZIP, available from tinyurl.com/yatpjhe.

AUTO-FILL YOUR CREDENTIALS

KeePass can semi-automatically fill in your usernames and passwords into web sites using its 'Auto-Type' option, which simulates you typing your username, pressing Tab, typing your password and then hitting Enter. To use this, just switch into KeePass from the window requiring your credentials, find the correct entry in your database and hit Ctrl+V (or the 'Perform Auto-Type' button in the 'Tool' menu). KeePass will automatically switch over to your previous application and enter your credentials for you.

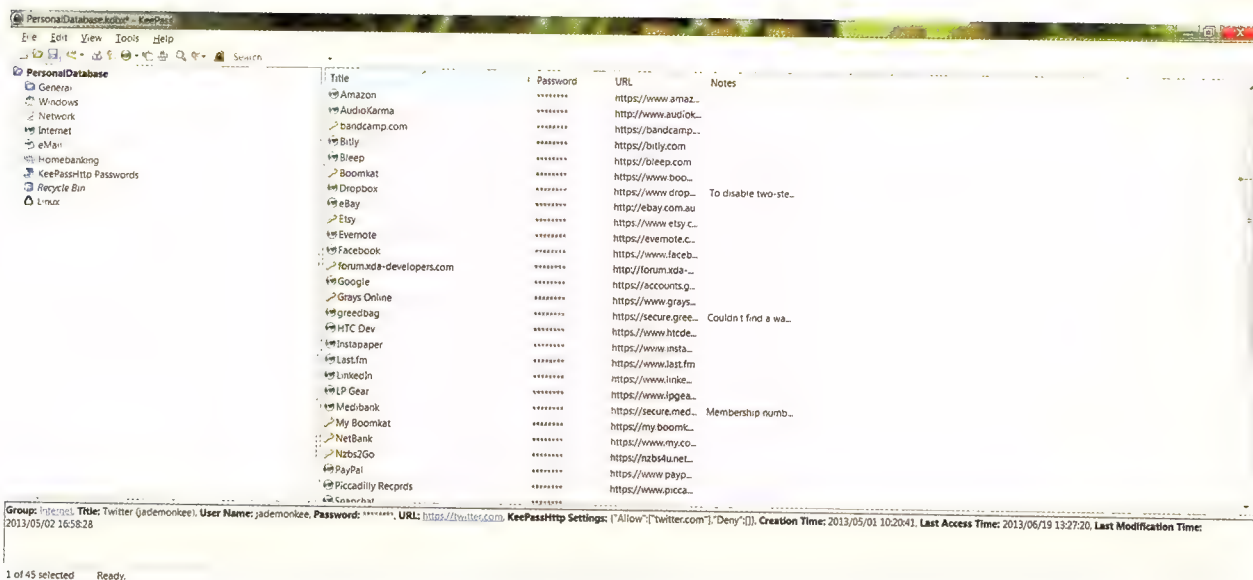
If you're having trouble getting 'Auto-Type' to work for a particular web site, each entry in your database has an 'Auto-Type' tab, which allows you to modify the key presses sent for that particular entry.

To further guard from keyloggers, this tab also allows you to enable the 'Two-channel auto-type obfuscation'. It's disabled by default and needs to be enabled for each entry, as it doesn't work with every application or web form.

GOING MOBILE

KeePass also runs on your smartphone/tablet, too. There are a number of different ports out there; just search for KeePass in your app store of choice. A popular one for iOS is KyPass, which has a sister app for Mac OS X. Our preference for Android is KeePass2Android, as it includes a replacement keyboard, which means you can just press the 'enter username' or 'enter password' keys, instead of copying and pasting between the apps. Very handy.

In short, there's no real reason for you to avoid using a password manager. The security benefits alone should be enough to justify it, but if you then also factor in that it actually makes entering passwords easier, you'll wonder why you didn't switch years ago. **BTTC**



KeePass offers a secure place to store all your usernames, passwords and more.

apc



On sale now
for only \$6.49



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Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

STORAGE

MOVIN' ON UP

Q If I have a 20GB boot drive, can I move the stuff on it to a bigger drive? I read that cloning even copies the partition. So if I cloned the 20GB drive to a bigger one, the bigger one would act as a 20GB hard drive. How do I get past this?

Joseph

A You can clone that 20GB drive to a bigger one and then increase the partition size to take up all the empty space on that larger drive. There are several ways to do this, but EaseUs ToDo Backup Free (www.todo-backup.com) is a good one-stop solution that makes it pretty easy. It'll let you clone your existing drive image to a larger one and adjust the partition size, either as you clone it over or afterward.

WINDOWS

ENTRY POINTS

Q I have a computer that, when booting up, shows some errors before the blue login screen. The errors say that certain entry points cannot be found. After I log on another error message appears that says Explorer, Services and a few other background

program entry points cannot be found. I have also tried booting it up on Safe Mode, but alas to no avail. I am running Windows XP SP1b (SP2 won't install because of some validation error). I hope this doesn't mean a clean reinstall.

Yashik Sookoo

A There is a way to fix this issue without reinstalling, but it all depends on how bootable your beloved machine currently is. The diagnostic clue in your question is that SP2 didn't install. Windows is supposed to roll back the SP if the installation fails, but power failure and certain error conditions can interrupt this. When your PC tries to boot up next, you have an operating system that's neither SP1 nor SP2. The error messages are caused by SP2 registry entries trying to access SP1 files. That's never going to work. You have to either roll back properly to SP1 or upgrade all the way to SP2.

When you get the first 'Entry Point Not Found' error, try hitting Ctrl+Shift+Esc to open Task Manager. You'll probably see some more error messages, but ignore them for now. Click 'File > New Task' and type `control appwiz.cpl` in the 'Open' box. This will start the 'Add or Remove Programs' applet. In the list of programs, you should see 'Windows XP Hotfix - KB834707'. Remove that and let your computer restart. You might still see some error messages this time, or you might not. Even if you don't, you can't just stop there. Removing that hotfix just gets Windows to the point where you can properly remove the rest of SP2. Use 'Control Panel > Add or Remove Programs' to do that. When it has finished uninstalling, you can go back to Windows Update and install SP3 directly.

If your Windows won't start reliably enough to let you remove the hotfix, you'll have to reinstall XP (we did warn you). This doesn't need to be a clean install, though - an in-place installation that copies the Windows files on top of your existing install will work just as well.

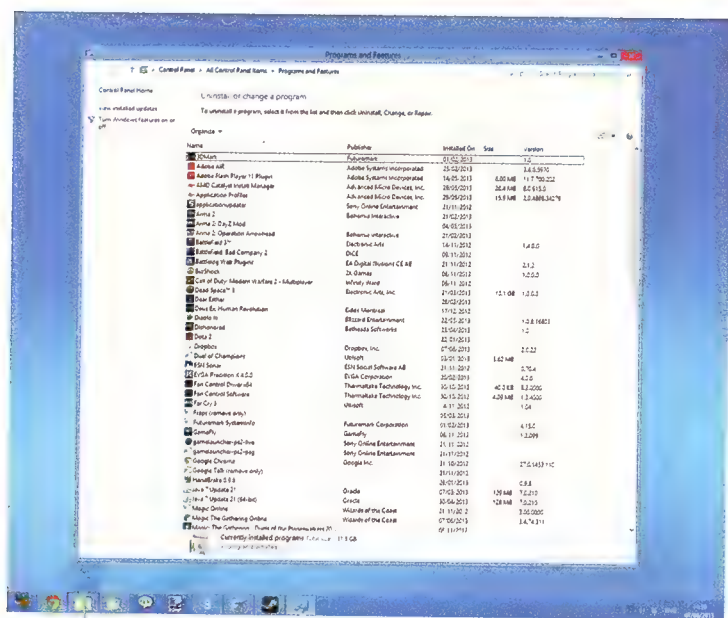
STORAGE

SLOW SSD RAID

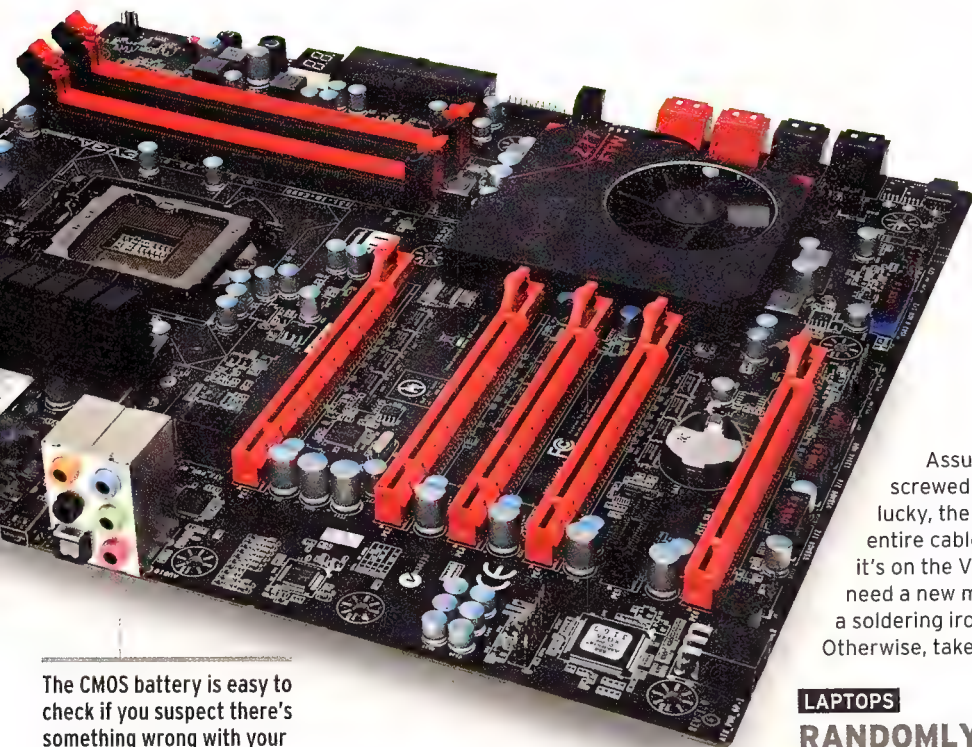
Q My boot drives are a pair of identical, fairly early 128GB Fujitsu SSDs that are booting Windows 7 in a RAID 0 configuration, and all my documents and programs are in a pair of 3TB Seagate drives in RAID 1. CrystalDiskInfo can't see past the Marvell controller on my ASUS P6X58-E Pro but its report is a little disappointing, showing a sequential read/write of 295MB/s and 116MB/s, respectively. Would I get similar results if these SSDs were standalone? My machine is completely ready in one minute from a cold start. Booting from the platter disk that I cloned takes 4.5 minutes.

Dave King

A The 6Gbps Marvell 9128 SATA controllers on X58 boards aren't very fast, at least not compared to the Intel native 6Gbps controllers from Sandy Bridge and later chipsets. This is partly because they connect to the motherboard via a single PCIe 2.0 lane. Secondly, your RAID controller can't pass TRIM commands from the OS



Problems updating to Win XP SP3? The solution is hiding in the 'Add or Remove Programs' applet.



The CMOS battery is easy to check if you suspect there's something wrong with your motherboard.

through to the drives, so they're slowing down as they run out of fresh sectors; however, if those are SandForce drives, as we suspect, the onboard garbage-collecting algorithms should help a little.

If you really want faster performance, you'd actually be better off cloning your RAID 0 to a single 6Gbps SATA SSD or recreating your array using a PCIe RAID card that uses four or more lanes. That said, there's no need to take drastic action if you're happy with the current speed of your drives.

DISPLAYS

VIDEO WOBBLE

Q I have a Windows XP SP2 PC. My PC has a problem with the display card. It changes colour whenever I shake or move the cable that goes into the PC. A tech guy said that when installing my motherboard, someone had done a lot of 'shaking'. To my understanding, they must have fought with my motherboard to cause the VGA part to work. Yes, it displays everything, but I can't tell the difference between France and Italy in *Pro Evolution Soccer 6*. If I shake the cable it loses the colour – it can even lose the image. I need help with alternatives. A new motherboard? Display card add-on? What do you suggest?

Tony Lancer

A We suggest you stop shaking the VGA cable. Colour glitches are a very common symptom of a loose VGA cable. Or they were, when people still used VGA cables. We can't remember the last time we saw a PC with an analogue video connection.

Assuming you've checked to make sure that yours is firmly screwed in at both ends, you have two possibilities. If you're lucky, the cable has a broken wire and you can just replace the entire cable. If you're unlucky, though, the break isn't in the cable, it's on the VGA port of the motherboard. You still probably don't need a new motherboard. You just need to be slightly handy with a soldering iron and you'll be able to patch it up again yourself. Otherwise, take it to a computer shop and ask them to do it for you.

LAPTOPS

RANDOMLY LOSING TIME

Q I recently set up an HDD password in the BIOS, but when I wanted to remove the password, it said it was frozen. So in order to reset this I had to remove my laptop's battery. Now, when I boot up, 90% of the time my system clock resets to the factory date and time. I know the battery is working, as I tested it. And I can save settings in the BIOS as well as the time, turn it off, remove the battery and power, then plug it in and boot and the correct time will be kept. If I just keep booting into Kali then the time seems to remain the same sometimes. Is there any way to fix this? Also, I have a second SSD with Ubuntu on it, in an HDD dock. Should I leave this dock powered on when the PC is off, since SSDs don't like to be switched on and off?

Leon Lewis

A This sounds like an intermittent fault. Most likely, the CMOS battery (the coin-sized one on the motherboard) is either not holding charge for long or there is a loose connection at the battery, possibly caused when you removed the battery in the first place. The easiest, cheapest and quickest test is to just replace the CMOS battery.

You said you'd tested it, but what did you test exactly? The CMOS battery is a lithium rechargeable cell. It might be storing some charge, but not enough to last for the time the laptop is turned off. Or the voltage might be just too low to reliably power the CMOS RAM. Anyway, you'd better hope it's the battery because the next most likely cause is a motherboard fault.

There's no need to leave your dock powered up, though. SSDs don't mind being turned on and off. We don't know where you got that idea from. They're probably more tolerant of power cycling than hard disks, if anything. **ETC**

APCMAG@BAUER-MEDIA.COM.AU Share your tech tips

Have you solved a tech problem or found a better way of doing things with your computer? Share your information with other APC readers by sending it in as a tip to apcmag@bauer-media.com.au, together with

your name and contact details (details won't be printed). Alternatively, if you have a technical question post it online on our forums at apcmag.com/forums and other readers may be able to solve it.

Supercharge your Steam games

Speed up your games with a novel use of RAM disks and Steam. Ashton Mills shows you how.

YOU'LL NEED THIS

STEAM

If you're not already on Steam, the free 1.5MB download is available at store.steampowered.com.

SOFTPERFECT RAM DISK

Head to www.softperfect.com/products/ramdisk to download and install this high-performance RAM disk app.



Ah Steam, we love thee. With the Summer Sale now finished, our wallets thinner and game libraries fatter, it's time to get down to some the serious business of playing.

Only, where are you going to put all these games? And, if gaming is your hobby, you more than likely have a decent PC – perhaps with 8GB or more of memory. Most games don't use more than 3GB at most, which is why when we looked at one of our 16GB systems, we came up with a novel way of making the most of it.

LIBERAL LIBRARIES

One of the more recent features of Steam is to make use of multiple Steam libraries, an oft-requested feature that Valve eventually implemented to help those with large libraries, small drives or both.

This is handy if you have a mixed SSD and spinning-platter drive system. Games can fit on the SSD for speed while less interesting files (we're looking at you, Office) can stay on the larger traditional hard disk. And if space on the often limited-capacity SSDs runs low, you can always swap games to and from the spinning-platter drive. But why limit yourself there? If you have enough RAM, you can create a RAM disk to store at least one game and play it at supercharged speeds, all but eliminating level loading times or micro-stutter caused by texture streaming – the type of which open-world games like *Skyrim* suffer from.

While SSDs are fast and can help with this, they're nonetheless slow compared to your system's RAM – up to 20 times in fact, depending on your system configuration. If you're playing from a spinning-platter drive, putting a game in a RAM drive can be up to 100 times faster. That's ludicrous speed. It's simple to do, too.

SETTING UP A RAM DISK

RAM disks are nothing new – they've been around since the dawn of computing, but with the ubiquity of cheap memory, they're seeing more and more uses in the consumer environment. And while there are some very good commercial RAM disk products you can buy, we'll use a free one by SoftPerfect for this guide because, well, it's free.

- 01 Head to www.softperfect.com/products/ramdisk to download and install SoftPerfect RAM Disk.
- 02 Once installed, launch it and *don't* click on the big '+' button to add a RAM disk just yet. Instead, click 'Image' and then 'Create Image'.
- 03 Click the folder icon and choose a location to store the RAM disk image. Make sure the drive has enough space for it. You can store it on a traditional hard drive or an SSD (read below for the pros and cons of this).
- 04 Make sure 'Image Type' is 'Volume', type in the size, set 'File System' to 'NTFS' and enter a 'Volume Label' like 'Games woohool'. Then click 'OK'.

Adding a new disk image with SoftPerfect RAM disk.

05 Now, hit the big '+' sign or click 'Disk', followed by 'Add'. Under 'Image File Name', click the folder icon and select your image.

06 Finally, give it a drive letter and be sure to tick 'Save Contents to Image'. Hit 'OK' and you're done!

You now have a RAM disk associated with a persistent image file. This is automatically saved at shutdown and loaded at bootup to preserve the contents of the RAM disk.

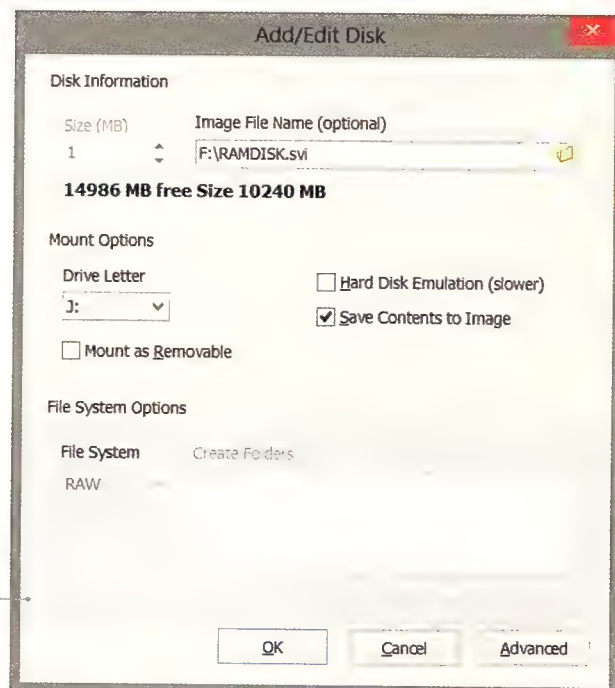
How big an image should you create? In general, allocate enough memory to fit your favourite game or games, but leave 3-4GB for Windows and the game itself in memory to run. To check the size of an installed game in Steam, simply right-click on it in your library, select 'Properties' and click on the 'Local Files' tab.

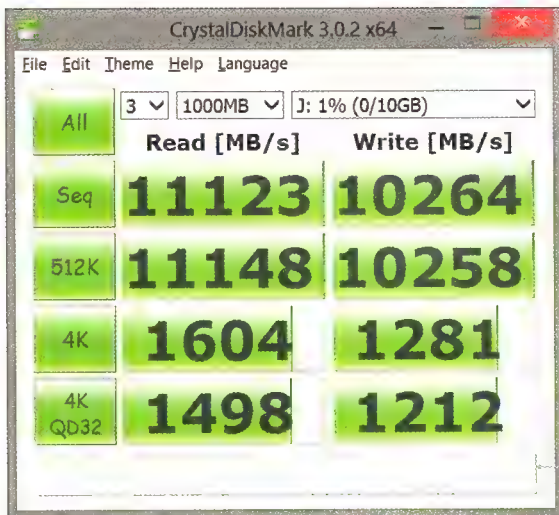
As for saving it to a hard drive or SSD, using an SSD will be considerably faster when shutting down and booting up, especially for larger images. However, writing a large data file like this every time you shut down could also conceivably contribute to the limited lifespan of your SSD. It's your choice to make and there's trade-off either way.

Alternatively, click 'Tools' followed by 'Settings' and deselect 'Launch automatically with Windows'. Then, simply load SoftPerfect RAM Disk when you want to play your game. But first, you need to put a Steam library on there.

SHIFTING STEAM

While Steam allows you to have multiple libraries, it unfortunately doesn't allow you to easily move games between libraries at this time. However, there are various methods of doing so, including using NTFS junctions to redirect directories and editing Steam's proprietary-format configuration files to forcibly set different directories for a





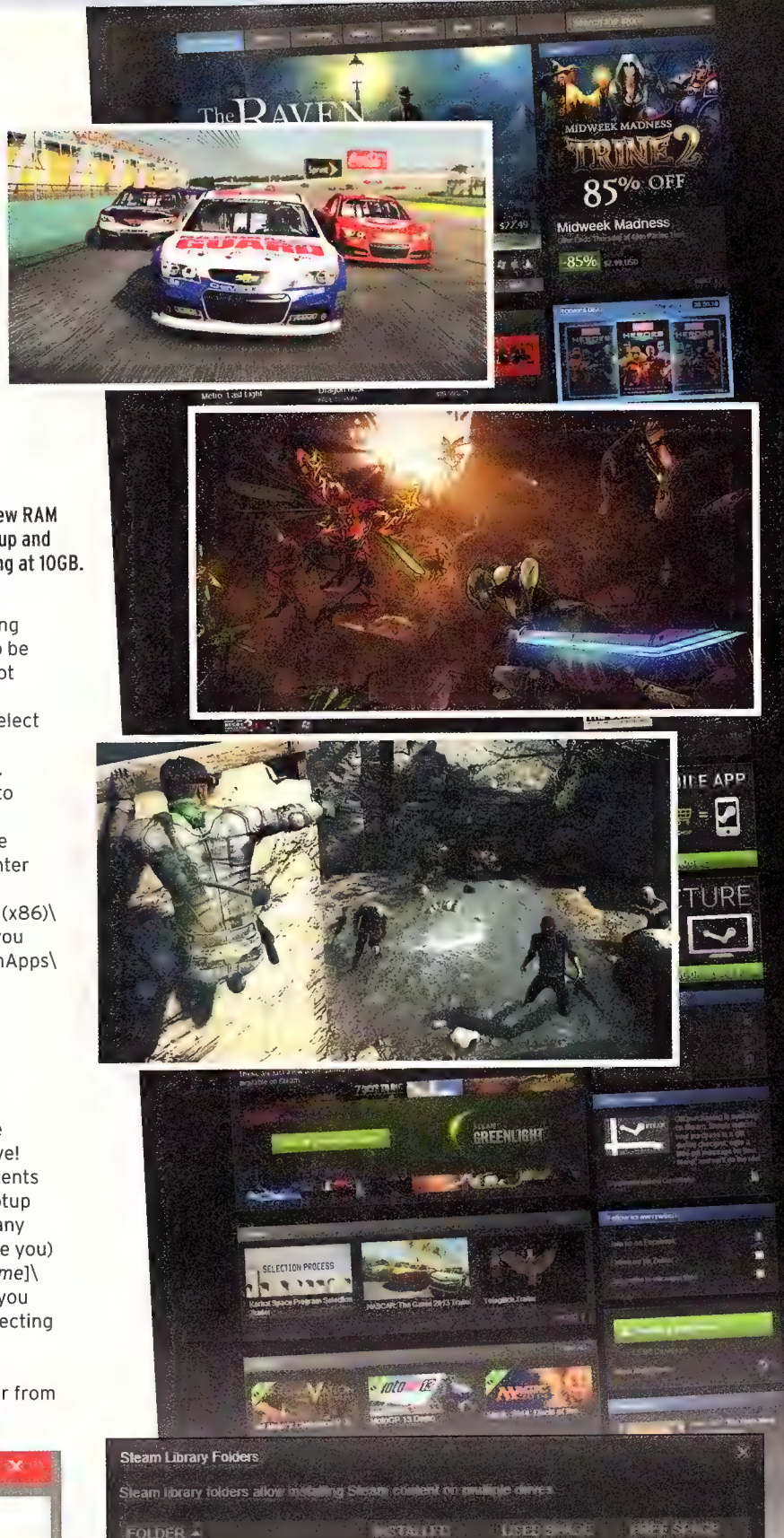
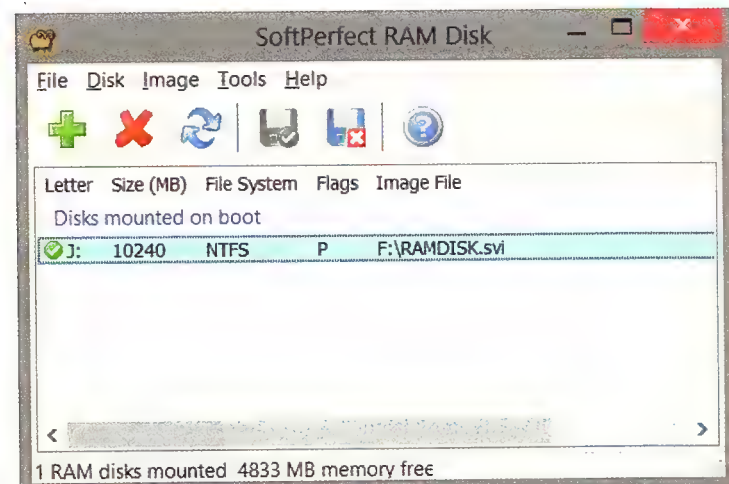
The new RAM drive up and running at 10GB.

game. The simplest method requires no command line command-ing or fooling about in a text editor. Incidentally, this technique can also be used for moving games between different libraries, even if you're not using a RAM disk.

- 01 First, make a new library in Steam. Click on the 'Steam' menu, select 'Settings' and then click on the 'Downloads' tab.
- 02 Click on 'Steam Library Folders' and choose to add a new folder. Point it to your RAM disk and click 'New Folder', which defaults to 'SteamLibrary'.
- 03 Shut down Steam and then browse to your RAM drive. Under the 'SteamLibrary' folder, make a new folder called 'SteamApps'. Enter this folder and make another folder called 'Common'.
- 04 Browse to your Steam install location (usually C:\Program Files (x86)\Steam) and navigate to SteamApps\Common to find the game you want to move. Copy the entire directory to SteamLibrary\SteamApps\Common on the RAM drive.
- 05 Start Steam, right-click on your game and select 'Delete local content'. Wait for it to complete.
- 06 Right-click on your game again and select 'Install Game'. When prompted where to install it, choose the Steam library on your RAM drive.
- 07 Steam will find the game files already present and complete the install immediately. Now you're ready to play from the RAM drive!

Naturally, when you shut down or unload the RAM disk, the contents of the drive will be saved to the disk image and loaded again at bootup or if you launch the program. Note that if you're concerned about any volatility of the drive or image (power loss, system crash, what have you) save games are almost always stored under C:\Users\[your username]\My Documents, not where the game itself is installed. That means you can lose the image or replace the RAM drive's contents without affecting your saved game.

Finally, don't forget if you want to move the game back to your original drive, repeat the above process but move the game's folder from your RAM disk library to your hard disk library. Enjoy! **ATC**



The RAM disk benchmarked with CrystalDiskMark (crystallmark.info). These results are approximately 20 times faster than the system's SSD.

Steam makes it easy to add new libraries to store your games. Here drive J: is the RAM disk.

A date with Olivia

The latest release of Linux Mint displays the possible future of desktop Linux itself, as **Ashton Mills** reveals.

YOU'LL NEED THIS

LINUX MINT 15 OLIVIA

Information and download instructions for Linux Mint 15 can be found at www.linuxmint.com/download.php.

Linux Mint, the popular challenger to incumbent desktop Linux poster boy Ubuntu, has evolved into a serious competitor. In previous versions its biggest selling point was largely that it tried to improve upon Ubuntu with unique apps and its own particular style. But with the release of Mint 15, codenamed Olivia, we're seeing something of a sea change. Mint has come into its own and with Ubuntu's shift to the Unity desktop, which didn't go over so well for many fans, it's becoming the Ubuntu that Ubuntu used to be: slick, easy to use and familiar. In fact, what we see with Mint 15 may well be the future of desktop Linux itself.

CINNAMON SPICE

Mint 15 comes in two flavours: Cinnamon and MATE. Cinnamon is the GNOME 3.0 branch while MATE continues to improve on GNOME 2.0. It's important to note that beyond simply bundling these versions of GNOME as the desktop, Mint developers are intimately entwined and developing for both projects, which gives them an inside edge and helps to direct the future of both desktops.

MATE, as it stands, is an incremental improvement of the GNOME 2.0 that Ubuntu left behind when it made the move to Unity – itself based in part on GNOME 3.0. But Unity was such a departure from the standard desktop interface that Mint decided not to follow. Hence MATE continues to bug-fix and improve on GNOME 2.0, and maintain a fast, light desktop interface that most users can recognise.

In the end, GNOME 2.0 has a limited lifespan. The very impetus for GNOME 3.0 was a desire to bring GNOME into the future and compete with interfaces like Windows 7 and 8, and the latest iterations of KDE. It must change to survive, but unfortunately, while the technologies in GNOME 3.0 bring it up to speed, the official implementation of the GNOME 3.0 with the GNOME Shell leaves a lot to be desired (see 'Common desktop environments' below) and is as much a departure from colloquial desktop paradigms as Unity is.

Hence Cinnamon was born, built upon GNOME 3.0, but designed to be familiar – a common 'Start' meme, navigable menu system and taskbar that anyone who's used Windows or Linux can simply jump right into.

COMMON DESKTOP ENVIRONMENTS

Linux is nothing if not versatile and it's no surprise that there's no single desktop environment for Linux as with Windows or Mac OS X. Indeed, there's a wide selection to choose from and most distributions will give you an option to use at least one of these alternatives. Mint itself provides separate install images for KDE and Xfce in addition to Cinnamon and MATE.

XFCE

www.xfce.org

Xfce calls itself a lightweight desktop environment and sports a cute little mouse as its logo as evidence. And indeed it's very lightweight and fast as a consequence. Where once it wasn't terribly pretty to look at, it has since evolved to be quite stylish given its limited resource use. Despite this, it still features composited effects like shadows and transparency. In fact, many Xfce users moved to it from bulkier environments like KDE and GNOME, not just because it's more responsive, but they actually prefer the look and feel of it. Xfce is the default interface for the Xubuntu spin of Ubuntu.



LXDE

lxde.org

LXDE aims to be the definitive lightweight desktop environment and boasts a smaller footprint than even Xfce, though to be fair, this depends on what else is bundled with it. On the whole the design modularises different features and programs to create smaller installs through reduced dependencies. LXDE runs on top of Openbox (see Fluxbox on page 86) and is known to use roughly half the memory of GNOME or KDE. Both Xfce and LXDE have been used in lightweight Linux distributions to run an entire Linux desktop in less than 64MB of RAM. With even today's smartphones sporting at least 1GB of RAM (and using most of it), this is *tiny*.



GNOME

www.gnome.org

Technically, GNOME underpins a variety of other desktops including MATE, Cinnamon and Ubuntu's Unity. However, there's also a stock GNOME 3.0 environment that you can install and it sports the GNOME team's vision of the desktop via GNOME Shell. GNOME Shell, like Unity, aims to redefine the Linux desktop interface paradigm and provides a number of features



The Linux Mint 15 desktop has a consistent, professional style.

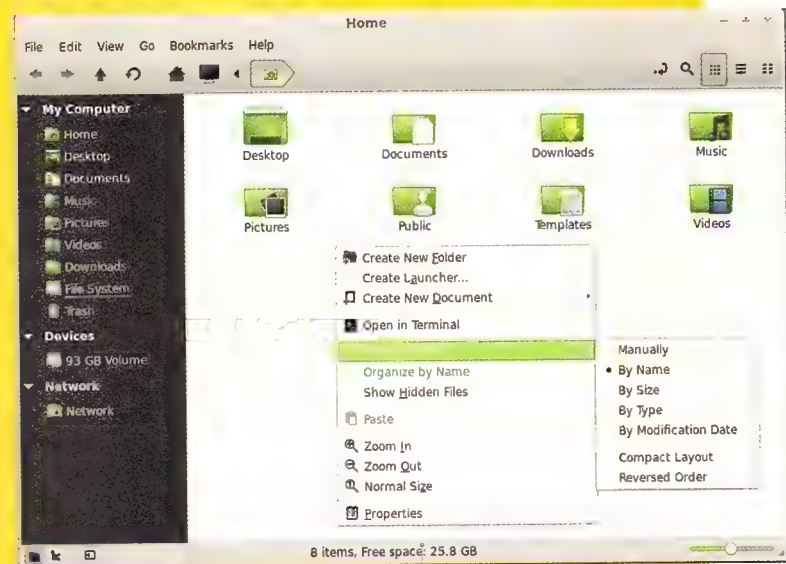


This is what makes Mint 15 and specifically, the latest version of Cinnamon, so interesting: its rapid development has seen it improve in leaps and bounds. In Olivia, it's so polished that it's easy to see it becoming the default desktop not just for Mint, but for any GNOME-based distribution. In fact, this is already starting to happen. Which is to say we may be witnessing the birth of a new de facto desktop environment for Linux, shaking up the foundations for all the popular distributions.

EXPLORING MINT 15

With Mint developers working on Cinnamon, the implementation in Olivia is a prime example of how good Cinnamon can be. On the surface it looks and feels much like a classic GNOME desktop, but it sports modern effects like animation and transparency, panel applets in the vein of GNOME 2.0, an updated and integrated notification system and inbuilt support for desklet apps. Compared to Ubuntu and Unity, some of unique features include:

- Classic 'Start' menu paradigm, with common shortcuts on the left and a navigable submenus on the right, along with an integrated search bar.



The Nemo file manager feels more polished than Files from Ubuntu.

not seen in other environments, utilising an 'Activities' meme to manage workload, a unified search to find applications and redesigned programs and tools brought forward from GNOME 2.0. However, these are some of the same features that served as the impetus for Cinnamon and MATE, for those users who aren't quite ready to give up their traditional 'Start' menu desktop paradigm. Users aren't the only ones who initially found GNOME 3.0 to be a departure from common sense, with Linus Torvalds himself calling it an 'unholy mess'. Times have changed, though, and GNOME 3.0 has improved. Most distributions that build upon it don't use the GNOME Shell interface, replacing it instead with something else as Ubuntu has with Unity.

KDE

www.kde.org

The K Desktop Environment is longer-standing than GNOME, with the project founded in 1996. Built upon the initially proprietary QT toolset, later released under a GPL-2 licence, KDE made revolutionary changes in version 4.0 that saw it lose popularity – much like GNOME is experiencing now with GNOME 3.0 – as it was redesigned from the ground up to support modern technologies as well as an entirely new framework and interface. Now that it's had time to mature, KDE is perhaps the most developed modern desktop for Linux and while it uses an entirely different toolkit to GNOME-based distributions like Ubuntu, it has its own popular proponents. It is a core interface for both Fedora, the community-driven fork of Red Hat, and SUSE Linux, the most popular distribution in Europe. Many distributions also have a KDE spin, such as Ubuntu with the appropriately titled Kubuntu.



UNITY

unity.ubuntu.com

Unity, of course, is Canonical's foray into user interface design for Ubuntu. Built upon GNOME 3.0, it provides a range of unique features such as the 'Unity' bar for program launching, the 'HUD' or 'intent-driven' interface and 'lenses' for filtering search results in the search bar. It was also partly designed with touch in mind, with the aim for Ubuntu to run on tablets (which it does) and smartphones (about to be released). Unity wasn't initially well-received as it diverged significantly from the familiar 'Start' menu and taskbar paradigm,



Driver Manager

- NVIDIA Corporation: G98M [GeForce 9300M GS]
This device is using an alternative driver.
- ☒ **nvidia-310 (recommended)**
Version 310.44-0ubuntu2
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **nvidia-313-updates**
Version 313.30-0ubuntu1
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **nvidia-173**
Version 173.14.37-0ubuntu1
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **nvidia-310-updates**
Version 310.44-0ubuntu2
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **nvidia-304**
Version 304.88-0ubuntu1
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **nvidia-304-updates**
Version 304.88-0ubuntu2
NVIDIA binary Xorg driver, kernel module and VDPAU library
 - ☐ **xserver-xorg-video-nouveau**
Version 1:1.0.7-0ubuntu1
X.Org X server -- Nouveau display driver

No proprietary drivers are in use.

Revert Apply Changes

Enabling third-party drivers is more user-friendly with Mint.

- Nemo file manager. While Files in Ubuntu replaced Nautilus recently, both don't compare to Nemo, which is cleanly laid out with an excellent crumb bar implementation and common settings like changing display layout or zoom accessible without digging into menus.
- Native support for desktop applets (such as clock, weather and so on) and extensions (Cover Flow, Docks and so on) along with the options to easily browse these tools online and install them directly from within their respective 'System Settings' dialogues.
- Expanded 'System Settings' control panel with integrated 'GNOME' and 'Cinnamon' dialogue boxes, along with a 'Normal' and optional 'Advanced' mode for more control.
- A cleaner and easier-to-use 'Software Sources' panel that includes the ability to ping repositories and select the fastest source automatically.
- Separate dialogues for 'Startup Programs' accessible from 'System Settings' (Ubuntu hides this for some reason), making it easy to manage what loads at boot. 'Device Drivers' has also been redesigned to be cleaner and easier to use than its Ubuntu counterpart for installing third-party drivers.
- A new login manager, MDM (Mint Display Manager), which supports classic GTK and GDM in addition to new HTML-based themes that support animation.
- The 'Mint Update' manager which, even with Ubuntu's recent changes to its update manager, is still clearly better designed and feature-rich, with configurability for update frequency and five levels of colour-coded update priorities.
- Easily-installed themes along with an integrated online browser to find and install more – something Ubuntu lacks entirely.

Then there's the cache of classic Mint-specific programs like the Firewall configurator, Upload Manager for sharing files, the excellent Mint Backup tool and the parental control Domain Blocker. All of these combine with Cinnamon and MATE to provide a more intuitive desktop

COMMON DESKTOP ENVIRONMENTS

but over time it's matured and is more usable than earlier releases. Still, many prefer a traditional desktop and hence distributions like Mint received a boost in popularity.



ENLIGHTENMENT

www.enlightenment.org

Enlightenment is as mysterious as its name and although not in common use, it remains one of the oldest and most flexible desktop interfaces for Linux. Originally designed and initially developed by Australian Carsten Haitzler, Enlightenment began as a means to provide modern visual effects and interface design at a time when Linux looked little better than Windows 3.1. It was remarkable, and still is, in that it added effects like transparency and animations that were slick and fast – all done entirely in software. Even today, all other desktop environments that portray these effects require hardware 3D acceleration to perform best, but not so with Enlightenment. This has naturally led it to be a good choice for embedded and low-power systems that can still display impressive visual effects sans hardware acceleration.

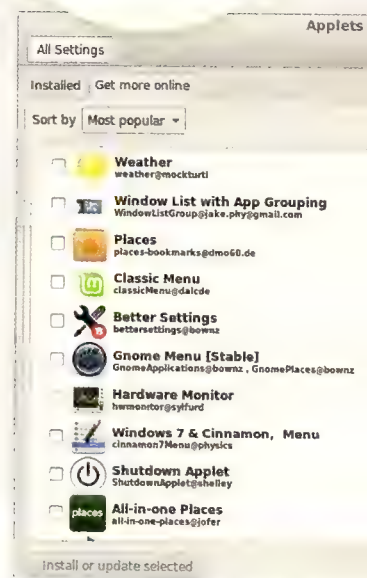
FLUXBOX

fluxbox.org

Fluxbox is very fast and very lean, and thus also ideal for low-memory systems. In fact, the standard Fluxbox install takes up less than 1MB. 1MB! Compare this to the stock GNOME install of some 200MB. Yet, it manages to look stylish and bundle most of the functionality you

expect: navigable menus, program launching, themes, clean window decorations and common GUI tropes.

Additionally, you can still run GNOME and KDE programs in Fluxbox with the appropriate libraries installed, which will naturally increase the disk and memory footprint, though not as much as a full GNOME or KDE desktop. Fluxbox started as a fork of Blackbox, which is visually identical and sports many of the same features. Another fork called Openbox began with Blackbox, too, and just like Fluxbox, it's low-memory, fast and stylish. Technically, a desktop environment sits on top of what's known as a window manager. The window manager handles the actual rendering of windows and the underlying graphical framework, while the desktop environment sports the look and feel, programs, settings and so on. Example window managers include Metacity for GNOME or KWin for KDE, but in some cases they're combined with the desktop environment, as is the case with Fluxbox or Xfce. To the end user there's no distinction, but the separation does allow for different combinations of window manager and desktop environment, as with LXDE.



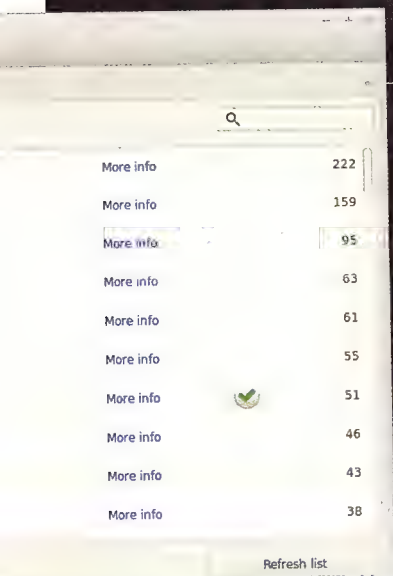
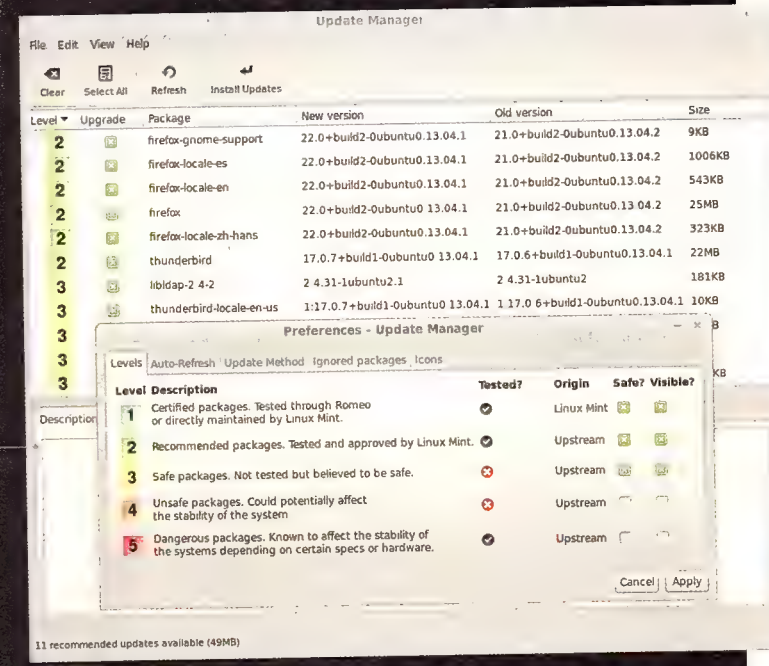
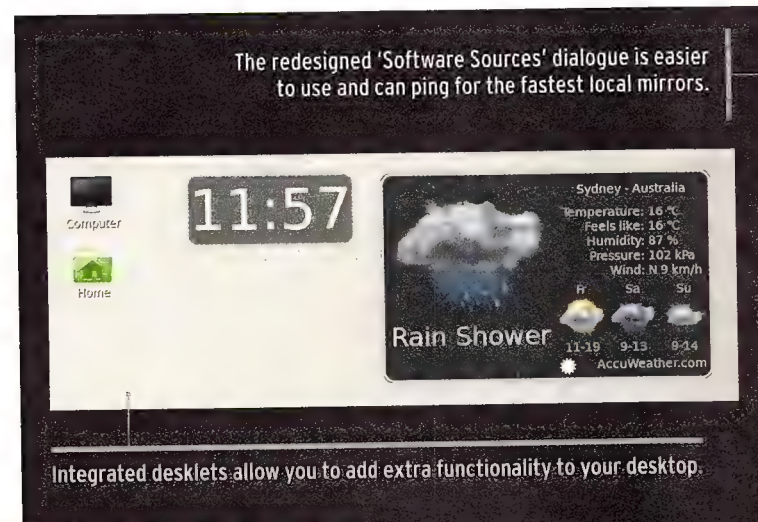
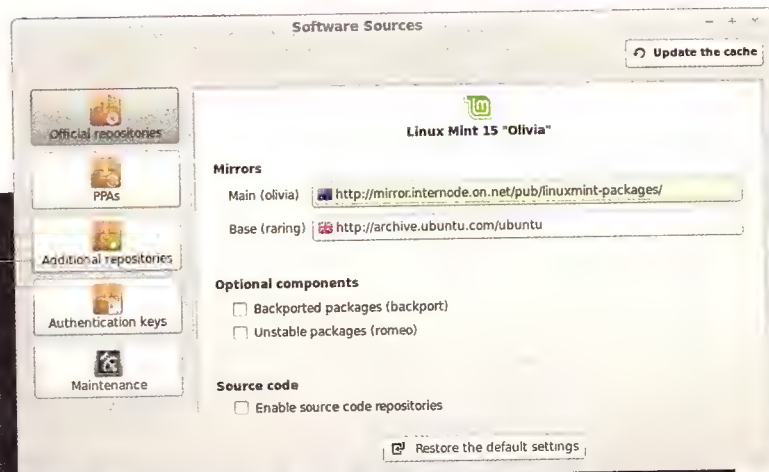
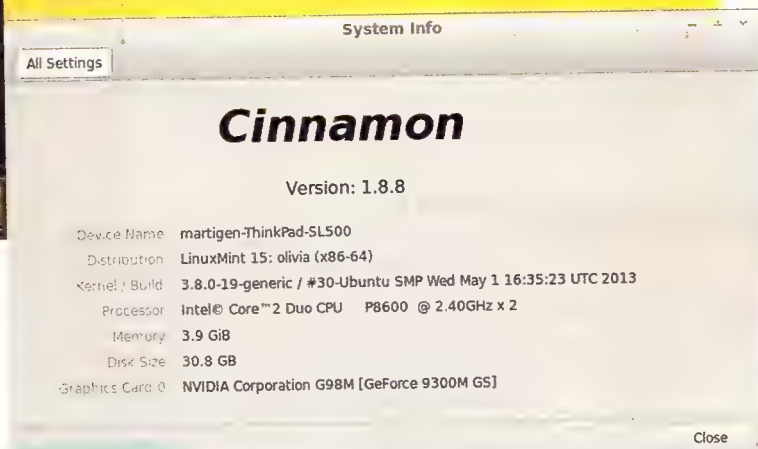


A range of new HTML5-based login screens allow for slick visuals and animations. The gears and blimps in this steampunk theme move.

Cinnamon is built upon GNOME 3.0 and is the primary interface for Linux Mint.

experience and with Cinnamon especially, a slick and modern feel to compete with Windows and KDE. After using Cinnamon for a while, despite the other advances of Ubuntu, it's hard to switch back to the Unity desktop (if indeed you want to at all). The irony, of course, is that Mint is based on Ubuntu, so even as its popularity climbs it will also be dependent on Ubuntu. Unless, in time, the user base becomes large enough to support independent development beyond Ubuntu (perhaps a base of Debian, much like Ubuntu still relies on Debian).

Either way, do yourself a favour and download the Cinnamon version of Mint 15 from www.linuxmint.com. Run it in VirtualBox if you must, but we recommend a bare-metal install. This isn't just an innovative take on an alternative Linux distribution, this is quite possibly the future of desktop Linux. **BTUC**



Extensions, applets and themes can all be browsed directly online and installed with ease.

The Mint 'Update Manager' is a clear improvement on the original Ubuntu one.

Fix Mac annoyances with Terminal

OS X can be a powerful and productive tool, but it has some... quirks. **Matthew J.C. Powell** shows how to fix a few pet peeves.

YOU'LL NEED THIS

TERMINAL

It's included in all versions of Mac OS X and is located in the 'Utilities' folder.

PET PEEVE 1: OPEN WITH WHAT NOW?

You may be aware that when you want to open a file in Mac OS X, you're not necessarily restricted to what the operating system regards as the default application. If you right-click (or two-finger-tap on a trackpad) on the file, you'll see a contextual menu that includes the command 'Open With'. Select that and you'll see a list of the applications you have installed that can open the file. Very handy.

Except that after a while, the list of applications can get a bit cluttered. Annoyingly, it can get cluttered with what appear to be duplicates of the same applications (Adobe apps seem particularly prone to this) and with applications you no longer have installed. A list that's impractically long is worse than no list at all.

However, you can fix it. It's actually pretty easy to get rid of the duplicates, as long as you're prepared to get your hands dirty in the Terminal.

TERMINAL CONDITION

Don't be intimidated if you've not used the Terminal before. It's basically just the gateway to the Unix underpinnings of OS X – you're not leaving your Mac, just using it a different way.

You'll find the Terminal in 'Applications > Utilities', or you can launch it by doing a Spotlight search for it. When it opens, you'll see a plain-looking window with a command line prompt, which will usually be your username followed by a dollar sign; for example, 'mjcp\$'.

The cause of a cluttered 'Open With' menu is what's known as the 'Launch Services' database. That's where the Mac keeps track of the applications you've installed and what types of files they can open. Over time, errors will creep in and multiply.

The solution is to discard the database and get OS X to

build itself a new one. In the Terminal, type the following, making sure to get the capitalisation right:

```
/System/Library/Frameworks/CoreServices.framework/  
Frameworks/LaunchServices.framework/Support/lsregister  
-kill -r -domain local -domain system -domain user
```

The process may take a minute or so, especially if you have a lot of applications installed, so don't worry if the Terminal doesn't look like it's doing anything when you hit Return. When the command prompt reappears, it's done.

In order to see the result, you have to log out and log back in again. Go to the Apple menu (top-left corner of the screen) to do that. Or if you want to prove your hacking chops now that you're a total Terminal expert, simply type `killall Finder` and press Return. That quits and relaunches the Finder, which has the same effect.

The next time you use the 'Open With' menu, you'll likely find it much more manageable.

PET PEEVE 2: AUTO-RESTORE ALL THE THINGS!

When Apple first showed off the feature in Lion, whereby closing an app automatically saves its state so the next time you open it it's exactly where you left it, most users were broadly open-minded about it. Sure, it's probably useful to be able to pick up where you left off. It's kind of how iOS apps work, too, so hey – welcome to the new paradigm.

In practice, it's fiendishly annoying. Over the years we've gotten used to closing all the documents we had open in a given app when we quit it and starting with a clean slate the next time. Especially with applications like Photoshop or Pages, where we'd often end up with scraps of things we needed temporarily while we were working on something,

QUICK TIP

KEY REPEAT

In Lion, Apple changed the behaviour of the keyboard when you hold down a key. Rather than repeating the symbol, as keyboards have done since time immemorial, holding down a key produced a pop-up from which users could select various accented characters.

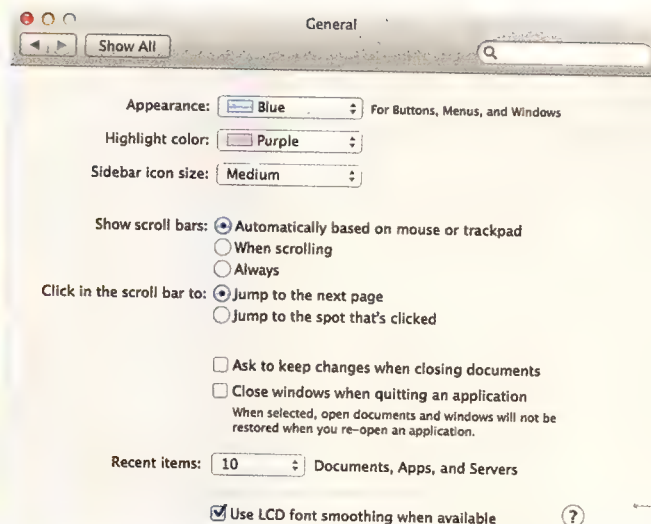
It's much the same as what happens when you tap and hold on the virtual keyboard in iOS and the benefit is obvious – if you have a need to type a lot of accented characters. If you don't, and you'd rather like to have that old repeating characters thing back, there's a simple fix.

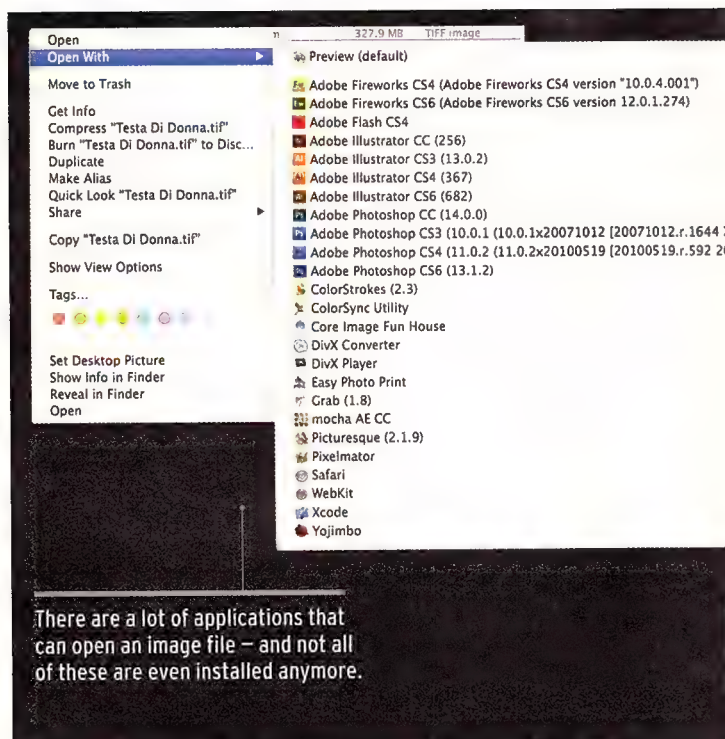
Open the Terminal and type:

```
defaults write -g ApplePressAndHoldEnabled -bool false
```

Then press Return.

Now, go to the Apple menu and log out and then log in again (you need to do this in order for the command to take effect). Press and hold a key and enjoy that sweet repeating. If you want the accented character selector back, simply repeat the process, but replace `false` with `true` in the Terminal command.





There are a lot of applications that can open an image file – and not all of these are even installed anymore.

As you can see, we no longer have the option of opening images in Windows applications that are no longer installed. However, we do seem to have more versions of Photoshop installed than we could possibly need.

QUICK TIP

STAY AWAKE

If you set your Mac a task that's going to take a while, there's always the chance that it might go to sleep before the task is finished and that can sometimes have dire consequences, especially if the task involves installing software. You can, of course, stop your Mac from going to sleep by opening the 'Energy Saver' pane of 'System Preferences' and setting the sliders to 'Never'. But where's the fun in that?

In Mountain Lion, you can open the Terminal, type the command `caffeinate` and press Return. Your Mac will then be prevented from sleeping until you stop the command (by pressing Control-C or quitting the Terminal). You can also set a timer on the caffeination, for instance, if you want to leave the Mac to do something that will take a couple of hours, but you don't want it awake all night. Simply type: `caffeinate -u -t 7200`. The number after the `-t` refers to the number of seconds you want the command to be operative. In this case, you'd get two hours before the Mac would go to sleep.

but no more. When we quit, we want them gone.

But, no. Since Lion, whenever we open Preview, Photoshop, Pages, textEdit, QuickTime or a host of others, there's the ghost of the last project we were working on, just waiting for us.

Since Mountain Lion, Apple provides a way to switch off the feature system-wide. In 'System Preferences', open the 'General' pane and tick the box next to 'Close windows when quitting an application'. There remains no way to switch it off on a per-application basis (if you want to have a clean slate with Preview, but keep track of open windows in Safari, for instance) and of course, Lion users have no way to switch it off at all. The good news is, there's a way. Again, it involves the Terminal. In the Terminal, type the following:

```
defaults write com.apple.QuickTimePlayerX
NSQuitAlwaysKeepsWindows -bool false
```

Press Return and then type `killall Finder` to make it take effect.

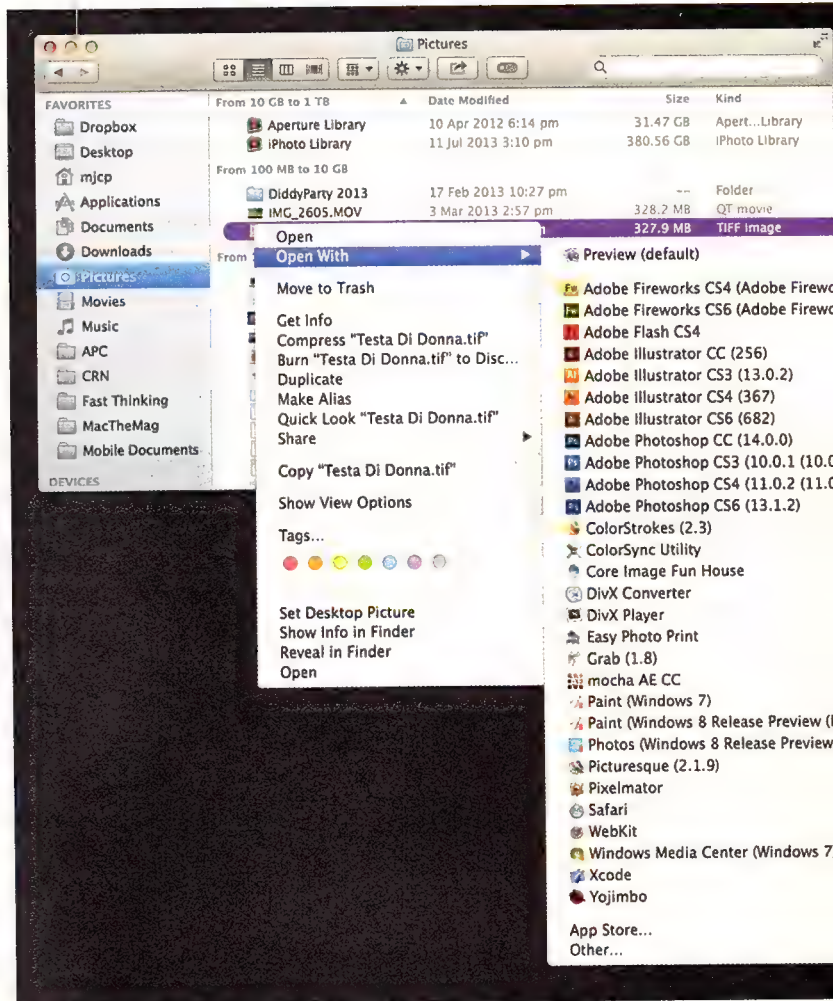
This example will disable the feature only for QuickTime Player X, but you can substitute the name of whichever application you want – Preview, TextEdit, Pages and so on. [BUC](#)

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and type:

Holding down a key is a convenient way to add accented characters, but you lose the key repeat behaviour that sometimes comes in handy.

In Mountain Lion, you can switch off the 'AutoRestore' behaviour using 'System Preferences'. But it's all or nothing – if you want to deactivate it for only some applications, you need the Terminal.



Use your iPad as a mobile recording studio

"The iPad is just a content consumption device," they said. "You can't use it to create," they said. They're wrong, says **Matthew J.C. Powell**.

YOU'LL NEED THIS

GARAGEBAND

Download the app from the App Store at tinyurl.com/b6mzl3a. It costs \$5.49.

If you had a dollar for every time someone's said that the iPad is purely for sitting back and consuming media, and you can't possibly produce anything of any particular weight on it, you'd have... well, you'd have a lot of dollars. Probably enough to buy an iPad, a microphone and a MIDI controller, and prove them wrong.

There are numerous apps on the iPad that enable you to compose and record music. Rather than go into the pros and cons of the various options out there, we're going to focus on Apple's own GarageBand – partly because it's very cheap, partly because it's very simple to use and partly because it has a direct desktop equivalent to which you can upload your iPad-created projects for further polish.

GarageBand has been on the Mac for some years and its core strength lies in its use of loops and samples to create music with relatively little effort. For advanced users, it offers the ability to record music using onscreen instruments; on the Mac, though, this feature is almost entirely symbolic. You simply can't play the onscreen instruments with any dexterity.

That's where the iPad comes in. If you have an idea for a neat drum riff for your GarageBand project, it's tortuous to enter it using the Mac version of GarageBand, but the iPad features onscreen drum kits for you to tap away at. They're even touch-sensitive, thanks to the accelerometer, so tapping harder makes the thumps louder.

GarageBand for iPad also features onscreen guitars, basses and keyboards – all touch-sensitive – making it ideal for jotting down musical ideas wherever you happen to be.

PLUGGED

For more serious musos, real instruments are the way to go and that's where one of the iPad's lesser-known strengths

comes in: you can connect MIDI instruments to it to record. iOS uses the same CoreMIDI framework as OS X on the Mac, so if you have a MIDI device that works with your Mac, it will work with your iPad. The trick is the connection.

There are two ways to do this. One is to get a specially designed MIDI interface for the iPad. The best known of these is the MIDI Mobilizer II by Line 6 (tinyurl.com/m9v4365). It pre-dates the iPad 4 and the Lightning connector, so you'll need to buy the adapter as well.

The other way is to use one of the many USB MIDI controllers out there, which can be had quite cheaply. To connect it to the iPad, you'll need – of all things – the iPad Camera Connection Kit. The kit contains a USB adapter that plugs into the iPad's Dock or Lightning port, depending on which version you have to suit your iPad. A well-known yet undocumented feature of this USB adapter is that it supports MIDI devices, not just cameras. If you have the older Camera Connection Kit and a newer iPad, it will still work through the Dock-to-Lightning adapter, although by the time you've plugged in your keyboard, your MIDI controller, the USB adapter and the Lightning adapter, it starts to get a tad unwieldy. This is all meant to be portable, right?

If you want to connect a guitar to your iPad, you needn't go through a MIDI controller. Line 6 makes a device called the Mobile In (line6.com/mobilein), which allows you to plug a guitar straight into the iPad as if it were an amp. Again, it's designed for pre-Lightning iPads, so you'll need the adapter as well. There are other solutions for hooking up a guitar to your iPad, but the Mobile In option is the most straightforward.

VOICE

It's quite simple to record your voice with an iPad, since the iPad has a microphone, right? Wrong. The iPad's inbuilt microphone is actually rubbish for recording. And don't think about using the microphone on a set of iPhone-compatible earbuds. Yes, it'll work, but the sound will be so compressed you'll sound like a GPS.

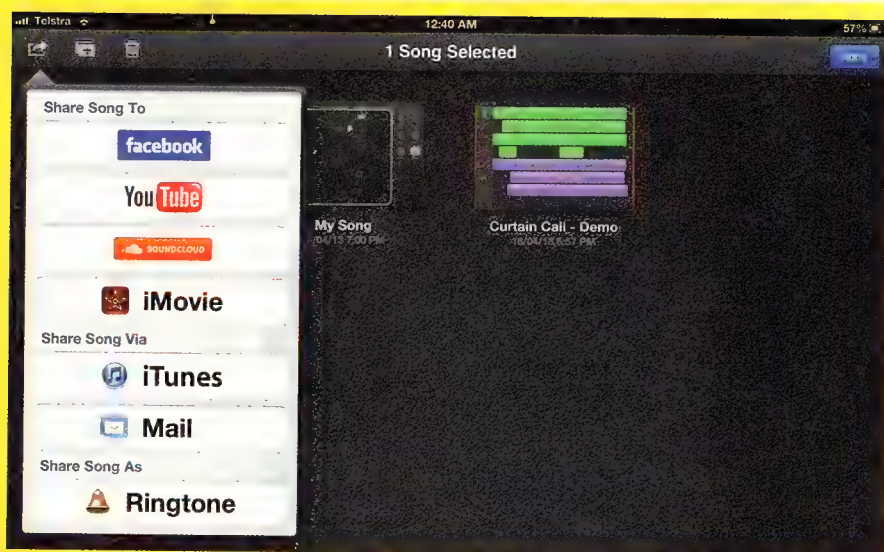
If you want a decent voice recording on your iPad, either for vocals or just spoken word (for a podcast, maybe), crack out the Camera Connection Kit and a USB microphone.

One thing to be careful of with USB microphones is that they're not all created equal. Not only in sound quality, which is highly variable, but also in power requirements. Some draw more current than others and if the iPad can't spare enough juice from its battery to run your microphone and itself, it will tell you so. For example, the excellent RØDE Podcaster (www.rodemic.com/mics/podcaster) is as good a USB microphone as you'll find, but its power requirements exceed what the iPad can spare.

Incidentally, RØDE also manufactures a device called the iXY, which is a microphone that plugs directly into the Dock port on an iPad (so again, you'll need the adapter for an iPad 4).

Another interesting option is the Mikey Digital by Blue

Considering how likely it is that people will want to take their GarageBand for iPad projects over to the Mac, it's not at all obvious how to do it.





Apple's iPad Camera Connection Kit has some hidden talents, such as support for microphones and MIDI adapters.

You can record your voice into GarageBand for iPad, then apply effects and filters there or wait until you load it into your Mac for more options.



Microphones (bluemic.com/mikey_digital), which is a microphone that plugs into the Dock (30-pin, again), but also includes a 3.5mm jack and an adapter for larger inputs. That means you can connect a non-USB microphone, a guitar, or any other line-level audio source.

GET IT TO THE MAC

OK, so you've recorded your brilliant idea for a drum track, a few flowing piano phrases, a guitar riff to die for and a vocal track to make the angels weep. What next? You can, of course, edit and polish it on the iPad itself if you're so inclined. However, you might prefer to finish it on the bigger screen of your Mac, where battery life isn't such an issue and you have some decent speakers.

The good news is this is quite easy. The bad news is Apple doesn't make it obvious how it's done, at least in the version of GarageBand for iPad that's current at the time of writing.

First, tap on 'My Songs' to see your collected works. Then, tap on 'Edit'. The icons for your various song projects will begin to tremble as if they're afraid of being deleted. Next, tap the project you wish to move to the Mac and then the 'Action' icon (top-left corner, the box with a

curved arrow). This is where you choose to share your songs to various outlets such as YouTube; what you want to do is 'Share Song Via iTunes'.

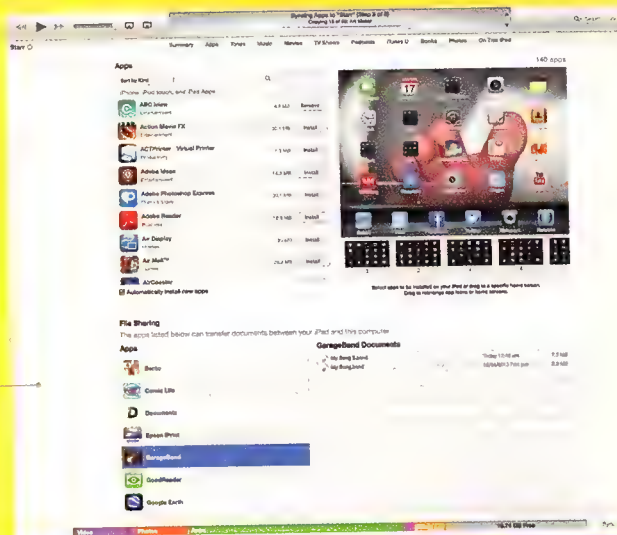
You're then given two options: 'Send it as iTunes' (which saves it as a completed song) or 'Send it as GarageBand' (which saves it as a GarageBand project complete with editable tracks). It's confusing because either way it has to go through iTunes, since that's the conduit for syncing between the Mac and iOS devices – Apple needs to rethink that. Choose GarageBand and your project will be saved, though you won't see where – the iPad's file system is inscrutable. Next, open iTunes on your Mac and plug in your iPad. Click on the 'Apps' tab and you'll see two sections on the screen: the apps available for syncing to your iPad and 'File Sharing'. The 'File Sharing' section lists all the apps on your iPad that can share data with your Mac. Click on 'GarageBand' and you'll see any songs you've saved for sharing via iTunes.

Drag your song from iTunes into a folder or straight into GarageBand and you're away. One important note: while GarageBand for Mac can import projects from GarageBand for iPad, it's a one-way journey – you can't export projects from the Mac to the iPad version. **91**



OK, it's not like bashing at a real kit, but if you have an idea for a drum riff, GarageBand's touch-sensitive drum kits are pretty functional.

The last step of getting your creation onto your Mac involves the 'File Sharing' interface in iTunes.



Customise your phone using Xposed

The Xposed framework offers a near-painless, powerful way to customise anything on your Android device. **Simon Chester** shows you how.

YOU'LL NEED THIS

XPOSED

Grab the install file from the XDA Developers forum app thread at tinyurl.com/cd46qco.

One of the very best features of Android is its ability to be customised. From replacing your launcher to installing an entirely new ROM, there's almost nothing that can't be tailored to just how you want it. But sometimes, especially now that OEM versions of Android are becoming so good, installing a whole new ROM can be a total pain, when all you're looking to do is change one little thing that you're unhappy with in an otherwise perfect package.

Aha! No longer! There's now a way for these types of system-level tweaks to be installed independent of a ROM, which means you can apply (or remove) as many tweaks as you wish, without having to do the dreaded wipe and flash shuffle.

This is possible thanks to a near-magical app/framework known as Xposed, created by XDA Developers forum member rovo89. Xposed installs itself at the system level (the installation therefore requires a rooted device) and is able to make non-permanent changes to the OS at every boot. Cleverly, it can even intercept commands from apps to the system, so it can modify the behaviour of any app or system process on your device.

This makes it incredibly powerful, especially since tweaks are created and distributed by the community and installed outside of the Xposed framework, just like a normal Android app. In fact, if you have some experience creating Android apps, you'll find it a cinch to create an Xposed module of your

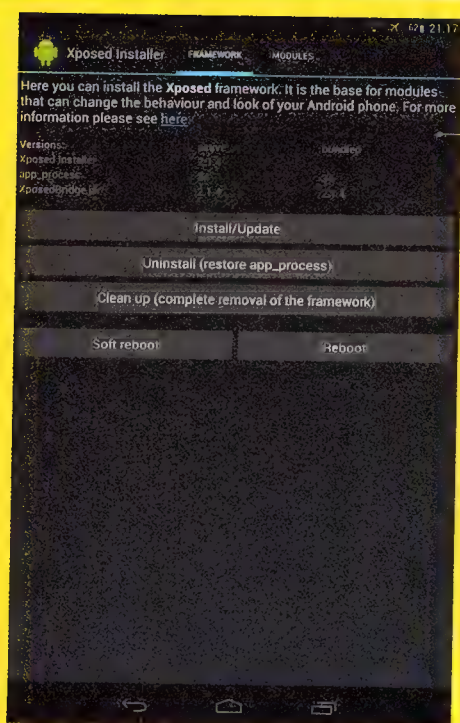
own – just follow the introductory guide at tinyurl.com/nwess9q. However, most of us don't have that kind of knowledge, so we'll have to make do with the modules already in existence. Thankfully, there are many.

So for this guide, we'll walk you through the process of installing Xposed, and finding and installing modules for it, as well as a quick intro to some popular modules.

First things first, let's start by installing the Xposed framework. You can grab the apk (install file) from the official app thread over at the XDA Developers forum (tinyurl.com/cd46qco). It's also a very good idea to read that thread, even though we'll be going into it here.

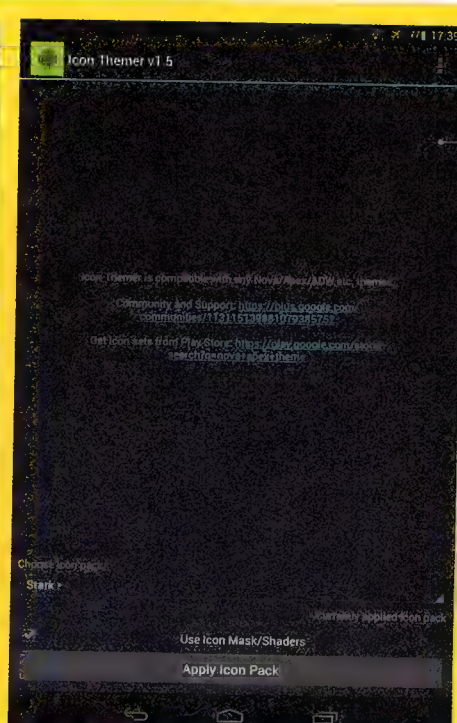
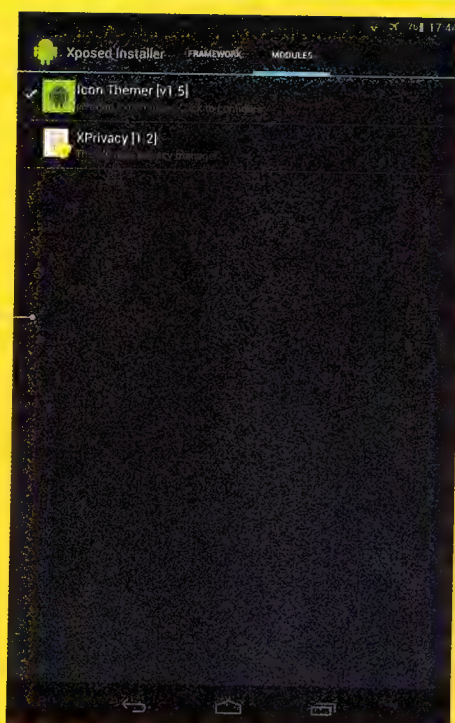
Pro tip: if you plan on installing Xposed onto a few different devices, perhaps place the apk and any subsequent modules you want into a folder in your Dropbox. This way they're all in one place and you don't have to deal with cables to access them – just click on the files from within the Dropbox app to download and install them (they're not very large).

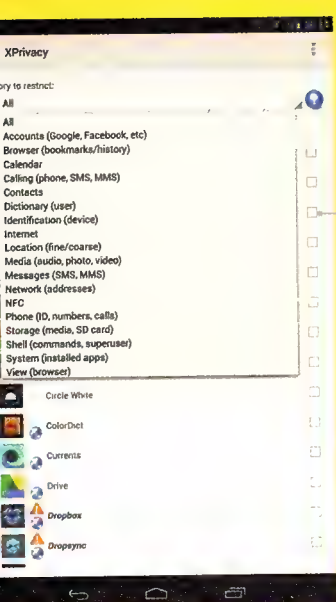
Once you've downloaded the installer, you just need to open it to install it. Do so now. You then need to open the installed app (it's called 'Xposed Installer') and hit the 'Install/Update' button. As we mentioned before, this will require root access, so be sure to grant it when the SuperUser pop-up appears. You don't actually need root access once this is done, so you can always unroot your device after this. You



Press the 'Install/Update' button to install the Xposed framework.

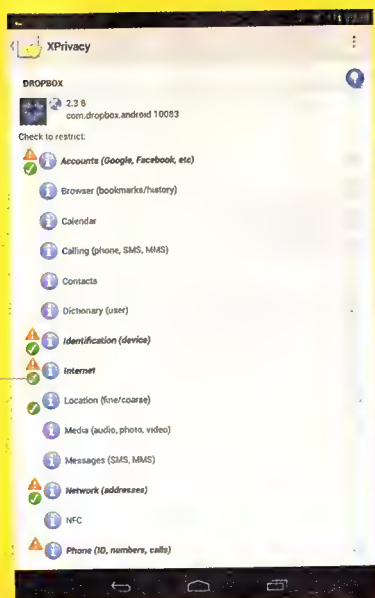
Modules must first be activated before you can use them.



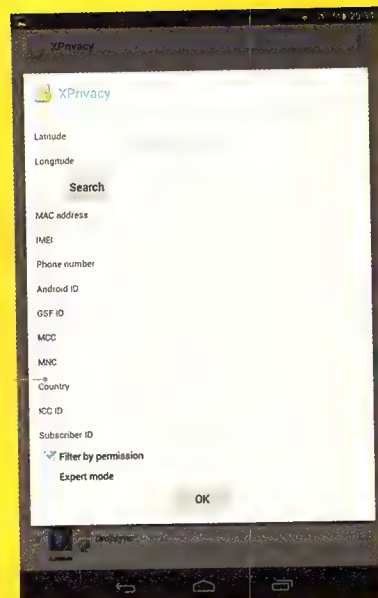


View which apps use what permissions with XPrivacy.

Select which apps receive modified information, as well as what info remains untouched.



Choose the information that you want to provide to apps.



know, if that's your thing. Once it's installed, you need to reboot.

Xposed is only useful if you have some modules to install. Unfortunately for us, the repository mentioned on the official thread (www.villainrom.co.uk/forum/microdownloads) was down at the time of writing, so we had to look elsewhere for modules.

The most obvious place to search for modules is within the XDA Developers forums (just search for Xposed). You can even limit searches to the forum for your specific device, so it will only return device-specific tweaks at the cost of generic ones. However, there are also a few other repositories, including the list at tinyurl.com/ns5sxdv; this collection by a single developer: tinyurl.com/p8wddhk; and for Samsung devices, tinyurl.com/megcpz5.

This obviously unlocks some very powerful capabilities, but they can also be very complicated, which means they may not work as expected or worse, may prevent Android from booting properly. If this happens to you, you can disable Xposed by rebooting into Recovery (Google how to do this for your device) and flashing the 'Xposed-Disabler-CWM.zip' that was automatically copied to your SD card when you installed the Xposed framework (good thinking, rovo89!). Alternatively, if you're handy over adb, you can just create the file /data/xposed/disabled on your device's internal memory (not the user partition or SD card).

MODULES

There are two Xposed modules that we've found that appeal to us the most: Icon Themer and XPrivacy.

To neaten up the appearance of our handsets, we always install custom launchers and icon packs. However, the icon packs only change the icons as they appear in your app drawer and on your home screen. Therefore the façade of uniformity crumbles when, say, the Android share menu pops up and exposes the icons that you tried so hard to remove. With Icon Themer, this embarrassing problem is no more.

You can download Icon Themer from tinyurl.com/kckvow5. Once you've downloaded it and placed it on your device (or in your Dropbox), just open to install it. Since Xposed can open up your device to nefarious intent, every installed module has to be explicitly activated before it can do its thing. To activate any module, just open the Xposed Installer app, navigate to the 'Modules' tab and place a tick in the checkbox. You can then open the Icon Themer app by clicking on its entry in the list.

Once Icon Themer is open, you just select which icon pack you want to apply from the list down the bottom of the screen, decide on whether you want to use transparencies (the 'Use Icon Mask/Shader' option) and hit the 'Apply Icon Pack' button. Note that Nova Launcher caches the icons, so you'll have to flush the icon cache by opening 'Nova Settings', holding the volume down button until the 'Labs' menu appears and then choose 'Labs > Debug > Clear icon cache'. This may differ on other launchers.

You can find an abundance of icon packs on the Play Store by searching for icon pack or a combination of adw/apex/nova theme. Some of our fave icon packs are 'Stark' by kovdev, the 'Holler!' series by yackovsky and 'Round Dark/White Theme' by Creativity.

The XPrivacy module is at the opposite end of the Xposed complexity spectrum (not a real spectrum) and allows control of the amount of info that apps are allowed to access on your system, on an app-by-app basis. Some other privacy protection apps simply block access to certain Android permissions (the ones shown to you whenever you install an app), which often confuses the apps and causes them to crash.

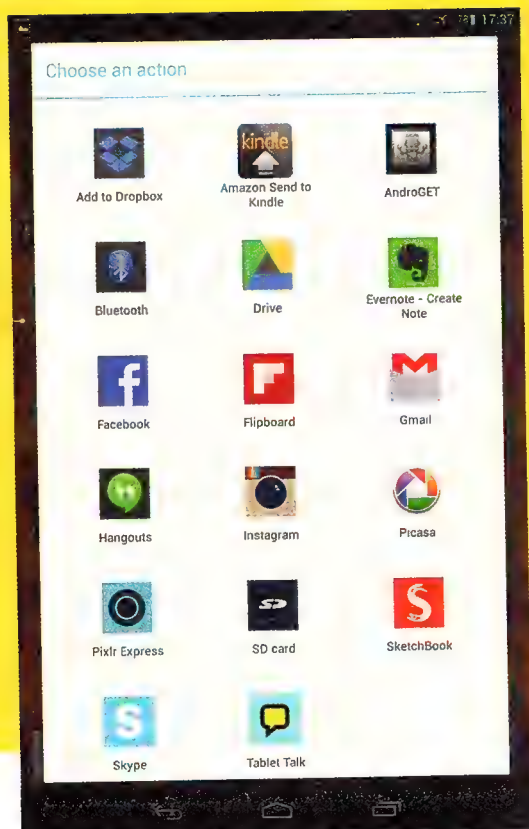
XPrivacy, on the other hand, allows you to change the information handed to the app, giving it dummy coordinates, contact details or anything else returned to it. You can also select which apps are given the bogus information, too, so that the apps you trust can still access the information they want.

You can get the install APK and learn a lot more about the app at tinyurl.com/jwr6v3q. Once installed, as with all modules, you'll have to activate it in the Xposed Installer and then reboot. Then, open the app and under 'Menu > Settings', you can fill in the information you want to send to apps. The list shows which apps have access to your information, as well as what information they've accessed. Placing a checkmark in the box on the right will restrict an app from accessing any information, while tapping the title of an app brings up a fine-grained control menu where you can choose exactly what information you want to restrict access to.

This is just a small taste of what you can do with Xposed. Start diving into the XDA Developers forums, as well as the VillainROM repository to see just what's possible and who knows? Perhaps a module exists that solves that nagging problem on your current ROM. [8pdc](http://tinyurl.com/8pdc)

Applying system-wide icon themes on any launcher is a cinch with Xposed.

Icons appear themed across the entire Android system.



Unleash the Haswell beast

Squeezing serious speed from your K-series Core i5 or i7 is easier than you might think. **Jeremy Laird** takes a quick trip to the BIOS.

YOU'LL NEED THIS

INTEL CORE i5-4670K CPU

Only Intel's K-series PC processors have fully unlocked CPU multipliers.

ASUS Z87-A

The ASUS Z87-A won't break the bank and includes Windows apps for fine-tuning.

CORSAIR HYDRO H55

With a quality water cooler like the Corsair Hydro H55 available for around \$80, why settle for an air cooler?

POWER METER

A mains-plug power meter is always a handy tool for keeping an eye on power consumption and making sure your overclock isn't putting too much strain on the PSU.

The dust has settled on Intel's new Haswell architecture and we're a bit underwhelmed by it – at least in desktop form. The CPU cores themselves have seen little change, there are no more of them and they don't ship at higher clocks either. What's more, in our tests, these fourth-generation chips weren't quite as overclockable as previous Intel generations.

However, Haswell chips are a little faster than Ivy Bridge. They're also by far the fastest mainstream PC chips around and they have oodles of overclocking headroom by any sane standard. Yep, that's the upside of Intel's awfully conservative strategy: it leaves plenty on the table when it comes to operating frequencies.

The fastest Haswell chip is the Core i7-4770K and it nominally runs at 3.5GHz, although it clocks up to 3.9GHz in Turbo mode. Intel chips have been capable of well over 4GHz for several generations. We've little doubt that Intel could have shipped at least a 4.5GHz model of many of its recent PC processors. In fact, you could say we've been a bit spoiled by their huge overclocking headroom. It's just not realistic to expect that to keep getting better.

With Haswell, though, we're still talking about big, tangible bumps in operating frequency. One thing that hasn't changed at all is that Intel still continues to lock down significant overclocking to a pair of K-series models; in this case, the Core i5-4670K and the aforementioned Core i7-4770K.

It's mainly the CPU multiplier you need to worry about. In fact, for quick and easy clocking, you can simply jump into the BIOS, knock the global CPU multiplier setting to 40 for a core clock speed of 4GHz, and then boot and reboot, increasing the multiplier in single steps. Odds are you'll only have to do that five or six times to find your chip's basic limit, which will give you at least 80% of what it will achieve with fine-tuning.

The base clock is still 100MHz and for the most part, it's still 'no-touchy'. That's not to say the base clock isn't adjustable, it's just that the way Intel ties together the timing

of its current CPUs means that bumping up the base clock has a knock-on effect on all sorts of subsystems, such as the PCI Express (PCIe) bus. That means the whole thing falls over if you mess with the base clock beyond a few percentage points.

However, there is one qualifier to that. For Haswell, Intel has introduced a new base clock strap adjustment. It was first seen in the Sandy Bridge-E CPUs for the high-end LGA 2011 socket. The shizzle here is basically a divider for the base clock – it means you can choose from 100MHz, 125MHz or 166MHz base clocks, while keeping the speeds of subsystems like the PCIe buses and storage lanes at their standard spec.

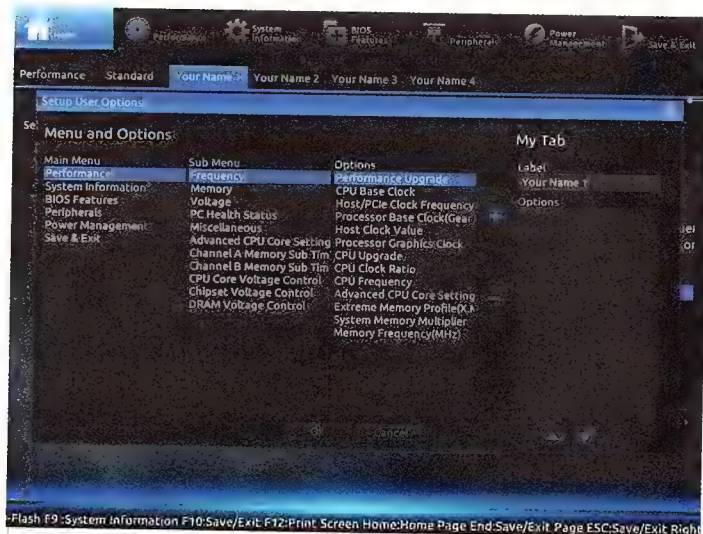
Of course, it's the base clock setting – combined with the CPU multiplier – that determines the ultimate clock speed of your cores.

The jumps of the base clock strap are pretty coarse and for most people, most of the time they don't offer much advantage. If you're trying to squeeze the last few percentage points out, though, the feature gives you a few options.

As for how you go about all this you have two basic choices. Some motherboard manufacturers offer Windows apps that give you access to most or all of these settings. It's a nice way of going about things and has the advantage of allowing you to tweak settings on the fly. That's good if you want to run at standard clocks most of the time, but crank things up for video encoding or gaming, for instance.

The common denominator option is the BIOS, which tends to be nicer-looking and more user-friendly than it was in the bad old days. One final note: Haswell tends to have a bit more trouble with heat dissipation than Ivy Bridge and Sandy Bridge, so an upgraded cooler is well worth looking into. We'd go for a water cooler on the grounds of effectiveness and minimal noise. A good single-rad 120mm water cooler can be had for around \$80, so it needn't break the bank, either.

So here's our guide to clocking the socks off your hot new Haswell chip.



The BIOS is easier to use and easier on the eye than ever before.



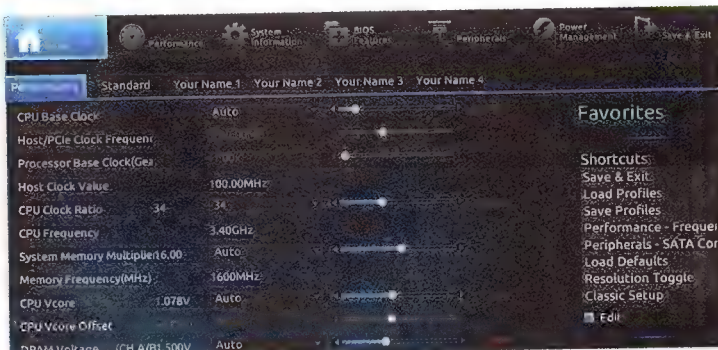
NEED FOR SPEED

Have no fear, the APC Haswell overclocking guide is here!



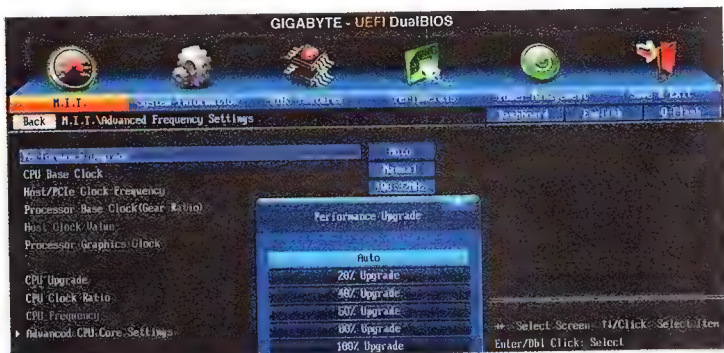
01 CHILL OUT!

You won't get very far without a solid cooling solution that's properly screwed down. We advise an \$80 water cooler for Haswell chips. A good PSU is also essential for supplying quality current. Both of these components are transferable to new systems when you upgrade your rig, so they're well worth a little extra investment.



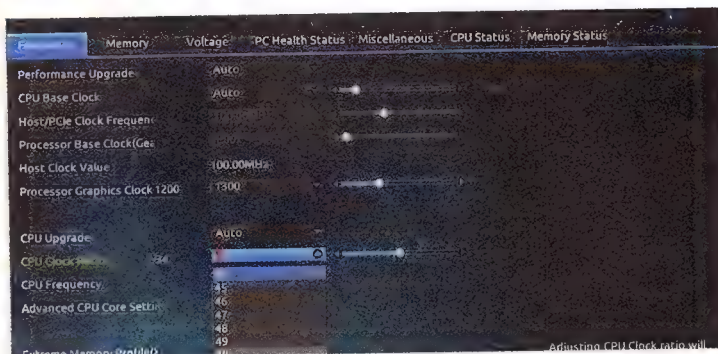
02 BIOS BASICS

First, get familiar with your BIOS basics and your system's default settings. Most motherboards will let you jump back to optimised default settings, so it's not a disaster if you twiddle with something unknowingly. Having a good feel for the default settings will help you navigate all the options and settle on a nice, stable overclocked spec.



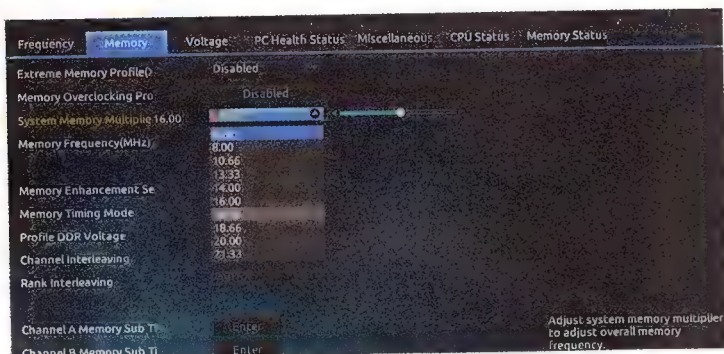
03 FULLY AUTOMATIC

Doing everything by hand is obviously the macho option, but motherboards are increasingly good at doing the work for you. Unless you're going all out for the maximum overclocking, give the auto option a whirl – if it hits 4.5GHz, that's probably good enough. You can also use the auto setting to get a marker for the CPU voltage setting.



04 ALL ABOUT THE MULTIPLIER

After you've given the auto setting a whirl and the CPU voltage is dialled in, the next step is the CPU multiplier. As standard, the base clock is set to 100MHz, so it's easy to calculate the end overclock from the multiplier. We suggest you jump to 40 for a 4GHz overclock and then increase the action in single-digit multiplier steps from there.



05 THANKS FOR THE MEMORY

In the old days, mucking about with memory was critical. That was because bandwidth was at a premium and overclocking only made it worse, and because overclocking was mainly done via the base clock and had a knock-on effect with the memory. Neither of these now apply, so don't worry about managing it beyond the XMP settings.



06 STRIVE FOR STABILITY

Once you've got your hot new Haswell overclocked, it's time to run a few benchmarks. Not only will this confirm that all is well in terms of performance (thermal throttling is always a worry), it will also make sure your settings are stable. It's not unusual for an overclocked rig to boot just fine, but fall over under heavy loads. **APC**



PART 12

Typography on the web

In this month's instalment of our HTML5 masterclass, **John Allsopp** discusses the evolution of typography on the internet.

YOU'LL NEED THIS

ADOBE TYPEKIT

A popular webfont service, available from typekit.com.

GOOGLE FONTS

Head to www.google.com/webfonts for a host of free open-source fonts.

APC EXPERT

JOHN ALLSOPP

With a background in computer science and mathematics – and a great deal of good fortune – John Allsopp's life collided with the web in the early '90s. For nearly 20 years he has developed software for web developers, built web sites and apps, and written books, countless articles and tutorials for print and online publications. In 2000, he wrote *A Dao of Web Design*, which over a decade later continues to be widely cited as the theoretical foundation for Responsive Web Design.

The web began as a simple, text-based medium. It drew many of its metaphors, particularly the idea of 'pages' from the language of print design. And yet, one of the key aspects of print design, the use of fonts, has for most of the history of the web been highly constrained.

In the beginning, the web had no way of styling text – no colour, no way of specifying fonts. With the first really popular browser, Mosaic, and its commercial stepchild, Netscape, styling features were added piecemeal to the web. Without any effort to standardise them, developers of different browsers added features like `bgcolor` attributes for various (but not all) elements and `font` tags for specifying the `color`, `size` and `font-family` of an element.

CSS1, introduced way back in 1996, provided a richer and far better approach to styling text, allowing developers to specify the weight and colour of text, whether text was italicised or underlined, as well as the font family, along with letter and word spacing, and much more. But a fundamental problem remained. We could only use the fonts already on a user's system. In response to this challenge, two separate ways of embedding fonts were implemented: one in Internet Explorer and one in Netscape. Embedded OpenType (EOT) was first implemented in Internet Explorer 4 in 1996. TrueDoc, a technology from BitStream, was included in Netscape 4 in the same year.

So for 17 years, we've technically been able to see any font we've wanted in our web page. And yet, until the last couple of years, almost no one did this. Rather, developers rendered text as an image and used the image in place of text, despite all kinds of problems associated with accessibility, search engine visibility and page load times among others. Why? A number of factors had an impact.

- Font foundries were reluctant to license fonts for use in this way.
- Two completely incompatible, non-standard technologies required a lot of extra work for developers.
- The results weren't particularly attractive anyway.
- Working with EOT in particular was technically tricky.
- CSS2 proposed a standardised way to embed fonts in a page, using the `@font-face` rule, way back in 1998, and this has been supported in Internet Explorer for many years. However, it wasn't until Safari 3.1 that any other browser supported font embedding in this way.

Why did it take these other browsers so long? Well, let's get back to those foundries, the people who design fonts. They were concerned that if their fonts were just being downloaded and used by browsers, people would easily work out how to locate the downloaded fonts on their system and

then start using these fonts for other things (for example, in Photoshop) instead of buying them. And with fonts costing tens, even hundreds of dollars, this would hurt the foundries.

Microsoft's EOT format made it difficult (if not impossible) to use a font except in the site with which it was associated, so it met the foundries' needs. Since it was difficult to work with, developers ignored it.

However, Safari supported the embedding of standard TrueType fonts. That meant working with embedded fonts was far easier than using EOT – hardly any more difficult than linking to a CSS or image file. Firefox quickly followed suit, with support for TrueType and OpenType fonts in Firefox 3.5, and suddenly there was a standardised way to embed fonts, supported across a wide variety of browsers, that wasn't a headache to use. A problem persisted, though, as Internet Explorer didn't support these formats, only the older harder-to-use EOT format.

On the back of this support and mushrooming developer uptake, a number of 'fonts as a service' companies sprang up, among them Fontdeck and Typekit (as an aside, Typekit was based on the ideas of the author of this article, who was a founding advisor to the company). Fontdeck and Typekit (now owned by Adobe) continue to this day, along with a number of other similar services we'll mention later.

In response to the concerns of foundries, the W3C aimed to standardise a format that would make it less straightforward to use webfonts with other applications. Microsoft proposed opening its EOT format for this purpose, but instead, a new format called Web Open Font Format (WOFF) became the standard. The font information itself is still either TrueType, OpenType or Open Font Format; the WOFF format is simply a wrapper for this font information and is compressed, making WOFF fonts typically quite a bit smaller than other font formats.

So, now that we know a little about the history of fonts on the web, how do we use them? Let's turn to that now.

EMBEDDING FONTS

Before we continue, a quick observation. Embedded fonts aren't *actually* embedded in our HTML documents. Rather, we link to font files on the web, which the browser downloads and uses to render the text of our document styled with this font.

There are two steps to using embedded fonts. We first specify a font using an `@font-face` rule. This gives the font a name and tells the browser where it can find the font. We then use the font as we would any other font in our CSS, using the `font-family` property.



As you might guess from our potted history of webfonts, although all browsers back to Internet Explorer 5.5, Safari 3.1, Chrome 4.0 and Firefox 3.5 support `@font-face`, they don't all support the same font formats. In short:

- Internet Explorer up to version 9 supported only EOT. From 9 onwards it supports TrueType and WOFF.
- WOFF is supported back several versions at least on all major browsers and devices, other than Android, where there is *still* no support in the default browser.
- TrueType and OpenType are supported in all major browsers and devices back at least several versions.

How does this help us? Well luckily, with `@font-face` we can specify multiple source files for a font, allowing us to cover multiple browser requirements. Our browser should then simply download only the first font in a format it supports.

USING @FONT-FACE

CSS has a number of `@`rules, at least some of which you might be familiar with. There's `@media`, which allows us to specify different style sheets to be used depending on the characteristics of the device, such as its screen width. We covered `@media` back in the December 2012 issue (see page 111). There's also the newer `@keyframe` rule, which we use to specify keyframe-based animation for the web. We covered these more recently in the May issue (page 94).

The `@font-face` rule is where we tell the browser about a font we want to use. Not surprisingly, we can have multiple `@font-face` rules in a document. In this article, we'll cover the core mechanism of embedding fonts, but as always, there are edge cases, gotchas and little tricks you may need to know about. I won't cover all of these here, but there are links to excellent resources throughout this article.

An `@font-face` rule has two key parts. The `font-family` property gives a name to the fonts linked in the rule. This is the name we'll use later in our CSS for the font. It also has an `src` property, which specifies one or more font files to be used, along with information about the format of the font. So, let's see this in action:

```
@font-face {
  font-family: 'Segoe UI';
  src: url('http://host.com/fonts/segoe.eot'), url('http://host.
com/fonts/segoe.woff') format('woff'), url('http://host.com/fonts/
segoe.otf') format('opentype')
}
```

Here we've defined a font called Segoe UI (there's actually no requirement for the name we use here to have anything to do with the actual font name). We provide three different versions of the font: an EOT, a WOFF and an OpenType version.

Now we need to actually use this font. Think about how we usually specify fonts in CSS.

```
h1 {
  font-family: Helvetica, Arial, san-serif
}
```

We use our embedded fonts in exactly the same way.

```
h1 {
  font-family: 'Segoe UI', Helvetica, Arial, san-serif
}
```

We just use the name we gave our embedded font using the `font-family` property in the `@font-face` rule as one of the fonts we specify for our element. We still provide fallbacks as we usually would, including the generic font family (in this case, `san-serif`). And that's really all there is to it.

What happens is that when the browser loads the style sheet, it looks at the `@font-face` rule. It then looks through the list of fonts specified in the `src` attribute and downloads the first font of a format it supports. When the CSS specifies a font with the name used in the `@font-face` rule's `font-family` property, it will use the downloaded font to render the text of that element.

Therefore in theory, we can use any font for any web content. In practice, there are two issues that need to be considered. Not all fonts

howto ● html5 masterclass

are licensed to be used in this way, so you can't simply upload a font file to a server and start using it like this. The other issue is that not all browsers support all formats, so we need to ensure there's the right format for each of the browsers we want to support.

Now that we've set up our CSS, let's turn to how we serve the font so a browser can get it.

SERVING THE FONT

Serving the fonts is almost as straightforward as serving an image file. We can simply upload our font file (depending on its licence terms, of course) to a web server and then use the URL of this file in our `@font-face` rule. There's one additional factor we need to take into account. When a server serves content, it's not just the data of the content that's served. In addition, meta data about the file is served, including the type of content at the URL (this is technically referred to as the MIMEtype). Most servers are set up to serve common types of content with the correct MIMEtype, based on the file extension, but this may not be the case with fonts. If a browser isn't using a font you think it should, this is one of the first things to check. Here are the MIMEtypes you should be using:

- .ttf – 'application/x-font-ttf' or 'application/x-font-truetype'
- .otf – 'application/x-font-opentype'
- .woff – 'application/x-font-woff'
- .eot – 'application/vnd.ms-fontobject'

We recommend you ask your friendly system administrator to make sure the MIMEtypes are set up correctly if this isn't something you usually worry about.

FONTS AS A SERVICE

While serving our own fonts is a great step forward, as we mentioned a number of services have sprung up to help smooth out the technical (and licensing) challenges of working with embedded fonts. These services take care of issues like serving the right font file to a browser, performance issues, as well as giving you access to huge libraries of professionally designed fonts from leading foundries and designers at typically a very reasonable price. Increasingly, developers use these services in place of serving fonts from their own servers. Popular services include Adobe Typekit, Fontdeck, Fonts.com, Fontspring and FontsLive.

You can see a detailed comparison of their strengths and weaknesses at '@font-face face off' (fffo.grahambird.co.uk). Many of these services

have a free offering, typically limited in terms of the range of fonts, or number of times a font can be served. However, there are a couple of very valuable free resources for webfonts.

- Google Fonts (www.google.com/webfonts). Google Fonts hosts a large number of free open-source fonts. You can find fonts based on various typeface characteristics and then use them as hosted by Google. A common criticism of these fonts is that many are of a lower quality than you'd expect to find at paid font services, which typically host professionally designed fonts from leading foundries and designers. It's certainly a great place to start exploring and working with webfonts, with no account or payment required.
- Font Squirrel (www.fontsquirrel.com). While Font Squirrel doesn't host fonts for you, it's a terrific way of discovering free-to-use fonts. It also filters fonts for quality and makes them easy to use, in particular with its highly recommended Webfont Generator tool (tinyurl.com/b56z7zq).

GOTCHAS

As with pretty much all sophisticated web technologies, there are some specific challenges to working with webfonts. Here are some of the most common.

As we saw, IE8 and older only supports the original Microsoft proprietary Embedded OpenType (EOT) format. Individual EOT files need to be built for each domain you're working with, using a very old and user-unfriendly tool that only runs on Windows. IE8 and older also has buggy support for `@font-face`, requiring a little extra finesse when building your `@font-face` rules. The article 'Bulletproof @font-face syntax' (tinyurl.com/oncc2ad) goes into all this in some detail, but in most cases I'd suggest not worrying about users of IE8 and older when it comes to using embedded fonts. The result almost certainly isn't worth the effort.

Font files can be hundreds of KB, even MB in size, so depending on the user's network connection, they may take some time to download. Browser developers thus face a dilemma. What do we do when the HTML and CSS for a document has been downloaded, but we're still waiting for the fonts specified? One of two options is open to the browser: don't show any text until the font arrives or show text in one font and then change fonts once the embedded font arrives.

The WebKit and IE developers chose the first of these approaches, which is why you might have seen web pages that seem perfectly laid out, but the text is invisible if you're a Safari or Chrome user. This is



Full Library Personal Library Trial Library Purchased Fonts

edit - A | A | Sort By Featured

 Freight Sans Pro BlaBla Fonts	 Futura PT ParaType	 Brandon Grotesque HVD Fonts	 Jubilat Darden Studio
 Proxima Nova Mark Simonson Studio	 Museo Slab exljbris Font Foundry	 JAF FacitWeb Just Another Foundry	 Omnes Pro Darden Studio
 Adelle TypeTogether	 Adelle Sans TypeTogether	 Prenton BluHead Studio	 FF Cocon Web FontFont

Classification ?

M M M M

M M M M

Recommended For ?

Design is an art of situations. Anthologies

Properties ?

G G G E E E

e e e o o o

Ab AB 246 246

This web site compares the strengths and weaknesses of the various font services.

Typekit, now owned by Adobe, was one of the early font services.



Atlantis, a poster for an imaginary Lost World's Fair by design legend Frank Chimero.

sometimes referred to as the 'Flash of No Content' (FONC). On the other hand, Firefox developers chose to show you the content in a fallback font and then restyle the page once the font has arrived, commonly referred to as the 'Flash of Unstyled Text' (FOUT). There really isn't a way around having at least one of these problems, but there are solutions if you want to change the way a browser responds by default and minimising the effect of either. See 'Dealing with the Dreaded FOUT' at tinyurl.com/2c7sowv for more information.

There are some other reasonably common (and at times baffling) challenges that webfonts can throw up, many of which are covered in

the article '@font-face gotchas' at tinyurl.com/ny5uflh. Once you've mastered the basic of webfonts, this is your next port of call.

INSPIRATION

Finally, what are people doing with webfonts? Here are some great examples and showcases:

- Lost World's Fairs – lostworldsfairs.com. Beautiful, clever, imaginary posters for World's Fairs that sadly never happened.
- Million Tree Challenge – milliontrees.ca
- Sparks Online – www.sparksonline.com [BPP](#)

@font-face

FACE OFF

	fonts.com	FontSpring	Font Bundles	Font Bundles	Font Bundles	Webtype	Kernest	WebInk	
Fonts	7,701	1,860	499	398	2,000	91	1,264	3,957	Fonts
Foundries	10	65	6	20	88	4	169	13	Foundries
Hosted on CDN	✓		✓	✓	✓	✓	✓	✓	Hosted on CDN
Self Hosted		✓	✓		✓	✓	✓		Self Hosted
No JavaScript	✓	✓	✓	✓		✓	✓	✓	No JavaScript
Desktop Use	✓	✓	✓	✓		✓	✓		Desktop Use
Free Trial	✓	✓	✓	✓	✓	✓	✓	✓	Free Trial
Payment Model	Tiered Monthly	One-off per font	Per font annual	Per font annual	Tiered Annual	Tiered Annual	One-off per font	Tiered Monthly	Payment Model
	fonts.com	FontSpring	Font Bundles	Font Bundles	Font Bundles	Webtype	Kernest	WebInk	

ARDUINO ON TWITTER

Tweet with your Arduino

An Arduino sending tweets? Absolutely! **Darren Yates** shows you how to get your Arduino its own Twitter account and tweeting automatically.

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User's* UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

From many people I've talked to, Twitter is one of those things you either love or hate. Even so, its hundreds of millions of devotees make it as key to the internet as Facebook or YouTube. If selfies from C-grade celebrities tweeting what they're eating or wearing isn't doing it for you, how about putting it to better use – with your Arduino? Yep, you can connect your Arduino directly to Twitter and have your microcontroller automatically send tweets that you can monitor on any Twitter client. All of a sudden, Arduino and Twitter becomes a combination full of possibilities.

TWITTER WEATHER STATION

If we're on about anything in this masterclass series, it's about being practical: showing, not telling. So we'll not only show you how to get your Arduino on Twitter, we'll show you how to create your own Twitter weather station that updates temperature and humidity every 5 minutes on its own Twitter account. And just to whet your appetite, we've done one of those 'here's one we've prepared earlier' jobs you can take a look at right now – just head over to Twitter and look up @IAMArduino (twitter.com/IAMArduino).

WHAT YOU NEED

Don't like soldering? Fine, because you won't need to do any for this project. Our Twitter weather station needs only a handful of parts that just slot together. Here's what you need:

- **Arduino Uno microcontroller board** (\$13 on eBay)
- **W5100 Ethernet Shield** (\$10 on eBay)
- **DHT11 temperature/humidity sensor** (\$3 on eBay)

After that, you just need a USB power brick to power your Twitter machine and an Ethernet cable with a spare port on your broadband modem. You can do the whole thing for under \$30.

HOW IT WORKS

With such a small parts list, you should be able to guess that the secret to getting this working is all in the sketch. In fact, this month's sketch uses up 27.5KB of the 32KB of flash storage available in an Arduino Uno, so there's not a whole heap left over. Still, it says something that you can actually

squeeze a Twitter post client into just 27.5KB of storage.

The first trick we've performed is getting the DHT11 to work by simply plugging it straight into pins D4 to D7 on the Arduino Uno, with the text panel facing outside. The DHT11 requires a supply voltage of up to 5.5V on pin 1, data communication on pin 2 and pin 4 connected to ground (0V).

The good thing about this little sensor is that despite having its own microcontroller on board, it only needs less than 5mA of current. Since an Arduino's digital outputs can supply up to 40mA, we can use the output to supply (and sink) the required power. By installing the DHT11 so that its pin 1 slots into D7, its pin 2 (the data pin) slots into D6 and so on down to pin 4 connected to D4. And by setting D7 to digital 'high' and D4 'low', we've just created a simple in-house power source that's more than enough to drive the sensor.

One problem we need to overcome by doing it this way is that the sensor's pin 2 data communications pin needs a pull-up resistor to work. All of the Arduino's digital pins can act as both outputs and inputs, but they also have internal pull-up resistors, so instead of configuring D6 to be a straight input, we set it to 'INPUT_PULLUP', which activates the pull-up resistor and it's good to go. You just need to make sure you install the DHT11 sensor into Arduino pins D4 to D7 with the text panel facing outside of the board.

ETHERNET SHIELD

In actual fact, you're installing the DHT11 sensor into the pins on the Ethernet Shield. This is one of those sandwich projects where the Ethernet Shield sits on the Arduino Uno and the DHT11 sensor slots into the same pins on the Ethernet Shield. All you need to do then is program the sketch into the Arduino, plug the Ethernet cable in one end and the other into your broadband router, add a cheap USB AC power adapter and you're good to go.

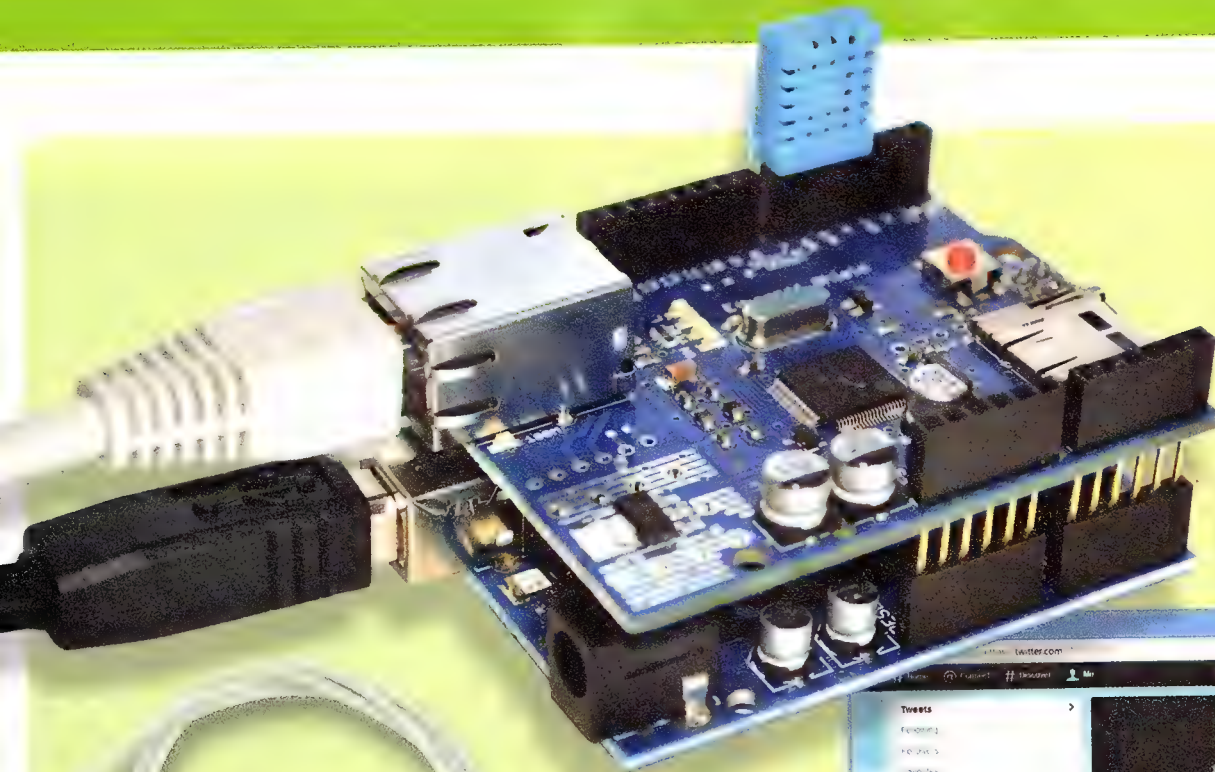
The Ethernet Shield will be the best \$10 accessory you'll buy for your Arduino. It not only gives you Ethernet and internet connectivity, it comes with a full TCP/IP stack so it's dead easy to program, and it also comes with a microSD card slot that you can load up to 32GB of storage into.

TWITTER LIBRARY

The magic that makes this all work is mostly down to Markku Rossi's excellent Twitter library. There are a few Twitter libraries for Arduino floating around, although they all require you to send your tweets through a third-party server, which is not only limiting, but not great for security either. Rossi's library doesn't – it allows your Arduino to talk to Twitter's servers directly and even handles the OAuth authentication protocol (secret handshake) that gets your tweets onto your Twitter account. You can find the library at Rossi's web site at tinyurl.com/nzw3fba.

GETTING THE SKETCH

You can download the sketch plus all of the libraries for the APC Twitter weather station from our web site at apcmag.com/arduino.htm. Download the ZIP file, decompress it and copy the contents of the 'libraries' folder into your Arduino IDE's 'libraries' subfolder. Remember to restart the Arduino IDE for the new library code to be added before you launch the INO sketch file. You'll find the Arduino IDE to program your Arduino available at arduino.cc. We recommend sticking with the latest 1.0.x version.

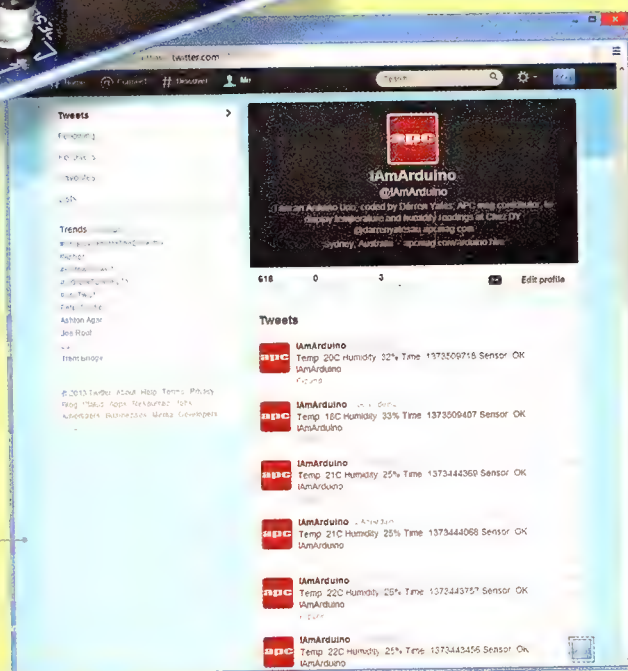


Our Twitter weather station needs no soldering and uses just three parts – build it for under \$30.



A window reed switch can turn your networked Arduino into a tweeting security system.

The final result. Check the 'Serial Monitor' output to see that it matches what you sent to Twitter.



Unfortunately, he hasn't made it easy to get hold of or work with. First, you have to use the GitHub source code repository software to retrieve it and his suggested method of obtaining the correct Twitter access tokens and secret keys requires compiling and running Java apps. So we've included his library in our download file this month, but we've also got a simpler method for getting those important tokens and keys.

SIGNING UP TO TWITTER

The first thing you'll want to do is create a Twitter account for your Arduino. There's no magic to this – get on your browser, head to twitter.com and create a new account. You may need to log out of your existing account to do it if you have one already, but otherwise, you're just creating a new account.

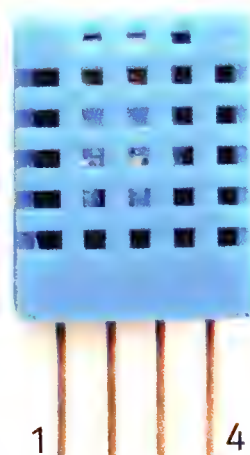
That's the first part. The next bit is a little more complicated. An Arduino Uno obviously can't use a web browser to interact with Twitter, so rather than using that front door approach, we'll go around to the back door and use Twitter's API (application programming interface) called REST.

It gets more complicated still. Twitter uses a series of passkeys based on OAuth, an open standard for authentication. The process is divided into two halves: a 'Consumer Key/Consumer Secret' pair and an app 'Access Token/Access Token Secret' pair. Our sketch code will need to supply Twitter with these key pairs before it'll be allowed to publish a tweet.

While Rossi's Twitter library handles that easily, you have to supply those key pairs. Rossi's example is to compile and run a Java command



1: Vcc 3: N/C
2: DATA 4: GND



The DHT11 temperature/humidity sensor does the hard yards of taking readings for the Arduino.

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line tool, which is fine but it needs Java and compiling. We have a simpler solution: do it on the web at Twitter's developers web site at dev.twitter.com/apps/new.

CREATING YOUR TWITTER APP

This process is normally used by web app developers looking to get their apps to hook into the Twitter engine, although it's equally just a way of signing up to get the 'Token Access/Token Access Secret' pairs and getting them connected with your app and your account. The bottom line is your Arduino board is set to become an app as far as Twitter is concerned.

You can see how to get hold of the key pairs in the step-by-step guide on page 103. When you get the pairs, you need to include them in the Arduino sketch. We've annotated it pretty clearly so you'll know where these keys are supposed to go. Once you've included them in the source code, compile it, load it into your Arduino Uno board and you're done. You won't need to do this again unless you decide to change Twitter accounts.

TRICKS WITH TWITTER

If you've had a look at our @IAmArduino Twitter feed, you'll see that each entry has the temperature, humidity and time, followed by a sensor check. There's quite a bit going on here that we're squeezing into 140 characters and it'll help you understand a few things.

First off, Twitter doesn't like you tweeting the same thing over and over again – *das ist verboten!* So what we do is use the Twitter library's 'gettime' function to return the current Twitter time in seconds as an unsigned long integer. Since that's guaranteed to always be different, we add this in to ensure each tweet is always different, even if the temperature and humidity haven't changed. This way, Twitter is guaranteed to accept it on this score.

You also need to play nice with Twitter and not spam its servers with 100 tweets every second. You also shouldn't abuse the system, particularly automating mentions and replies – you can read more at tinyurl.com/78xjo9d.

The most important thing to remember is what's called the Twitter rate limit – it's the number of times you can request or send information to the Twitter servers per hour. Ultimately, you can make no more than 350 authenticated (OAuth) calls per hour, a bit under 10 per minute or call it nine to be safe. Remember, though, that's not just sending tweets – that's any OAuth access. The Twitter library has far more commands than we're using here, but every command that requires OAuth access will chew up one notch on your rate limit per hour, so just be aware of it. Our sketch here tweets once every 5 minutes, although it's easily changed.

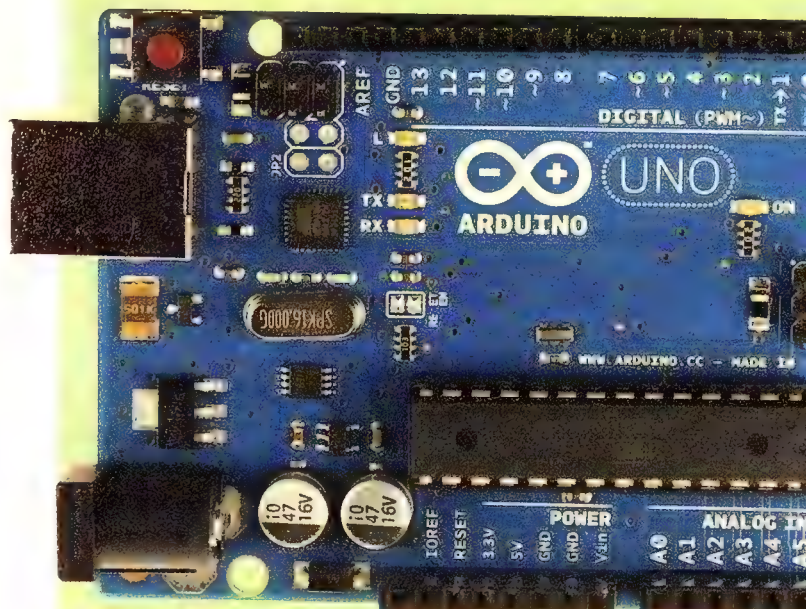
TWITTER CHANGES

It turns out our timing for this project couldn't have been worse. A few weeks earlier, Twitter switched from API version 1.0 to 1.1. That basically broke a lot of apps and changed the way you can tweet and view user timelines. It also broke our Twitter weather station and our ability to read tweets. In the short time since then, we've managed to get our sketch working again to post, but we still can't read tweets. And if you can't read them, you can't use Twitter to control your Arduino, so unfortunately, we'll have to put that side of our plan on the backburner until we figure out a solution.

The main issue is that you now need authentication to read any user timeline via the API. That requires extra memory to store away the OAuth key pairs we didn't need before, memory the Arduino doesn't really have to spare, particularly when we need RAM to read the tweet as well. Given that we're also down to just 4.5KB of storage remaining, at the moment it looks as though we've hit the Arduino Uno's end stops for the first time in this series. We'll see how we go.

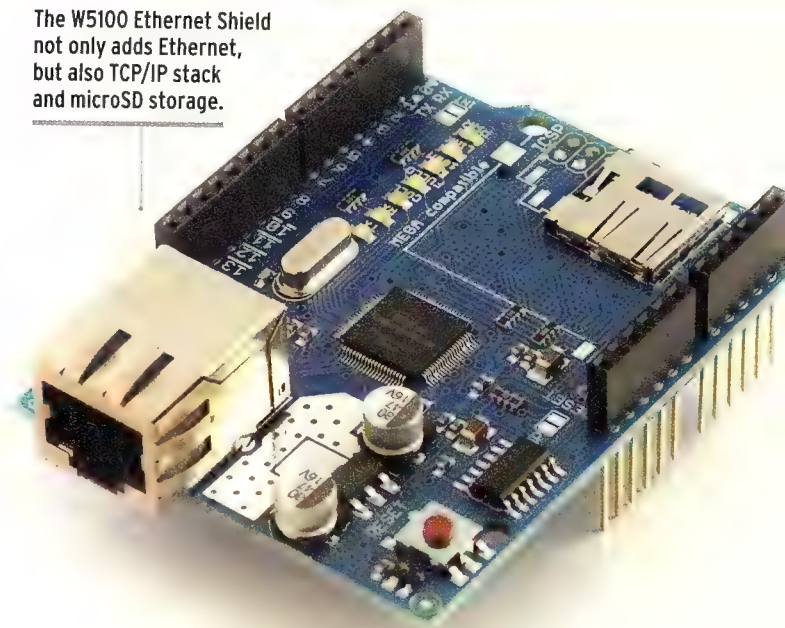
TWITTER SECURITY

One of the great things about Rosso's library is that you're not sending your security tokens and keys as raw text over your network. They're encoded using SHA1 (secure hash algorithm), so they're about as secure as you can make them – at least on an Arduino. If you peer into the 'twitter.cpp' file in the Twitter library, you'll see how it all works if you look closely.



The Arduino Uno board we've used throughout this series is available on eBay for around \$13.

The W5100 Ethernet Shield not only adds Ethernet, but also TCP/IP stack and microSD storage.



USE YOUR IMAGINATION

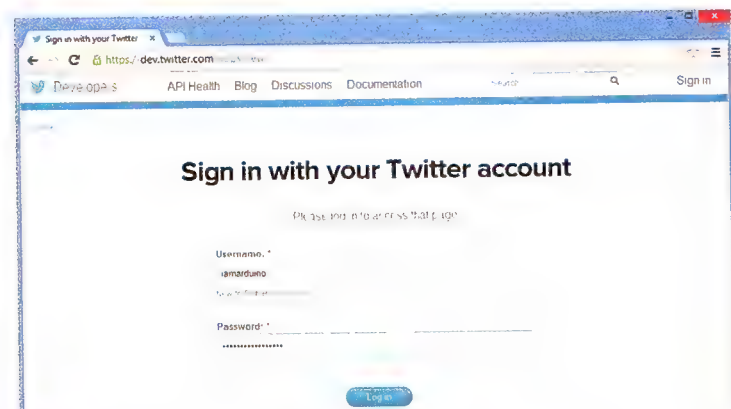
We're using the Arduino here to automatically tweet temperature and humidity every 5 minutes, but if you desire you could also program your Arduino to tweet on a trigger. Here are just a few ideas we've come up with.

- Use an HC-SR04 ultrasonic sensor and send a tweet whenever someone passes through the ultrasonic beam – you've got a simple tweeting entry alarm system.
- Have a light sensor such as a light-dependent resistor (LDR) inside your bar fridge so that whenever the door opens and the light comes on, it triggers your Arduino to tweet that someone's raiding your beer.
- Use what's called a window reed switch to trigger code that tweets if a window in your home is opened.

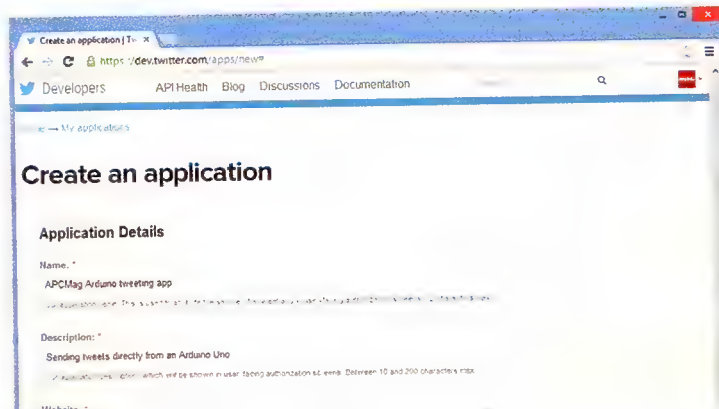
There are plenty of other applications. The great thing is that it's all just limited by your imagination.

GET SECURITY TOKENS FROM TWITTER

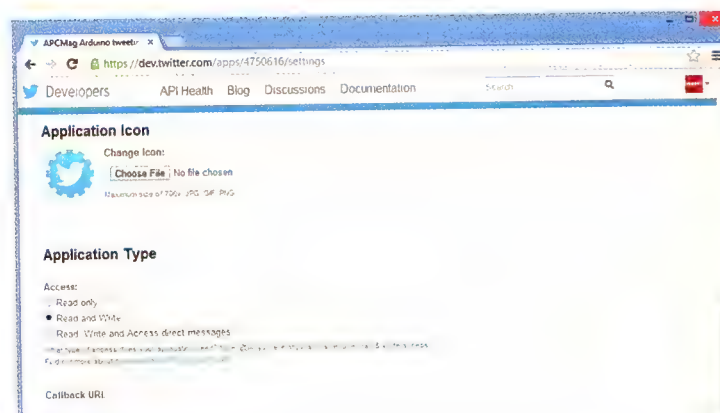
Your Arduino will be sending Tweets in just five simple steps.



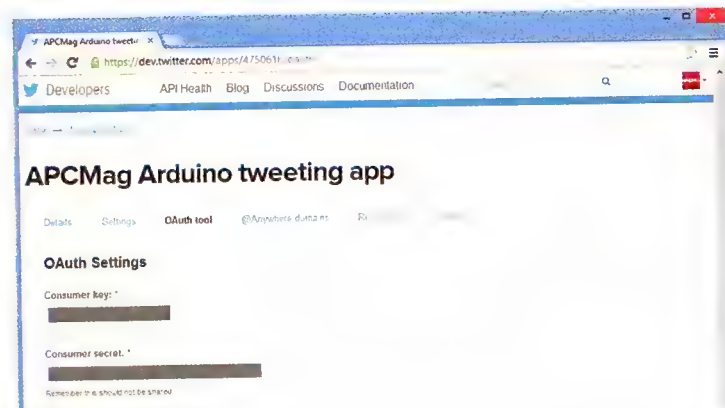
01 Point your browser to dev.twitter.com/apps/new and sign in with your Arduino's Twitter account details that you just created. Haven't done it yet? Do it now the usual way.



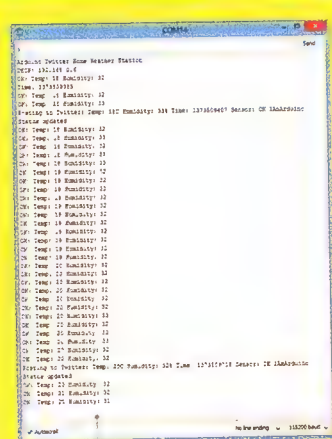
02 On the 'Create an application' page, give your app a name and a basic description. You'll also need a web site address (create a free Blogger page at www.blogger.com if you don't have your own). Agree to the terms of service, fill in the CAPTCHA and click the 'Create your Twitter Application' button. Approval is automatic.



03 When you see the new app page, click on the 'Settings' tab, scroll down to 'Application Type' and click the 'Read and Write' button. Do that and click the 'Update this Twitter application's settings' button at the bottom of the page. Give it a few seconds and then refresh the page to check that the changes have taken effect.



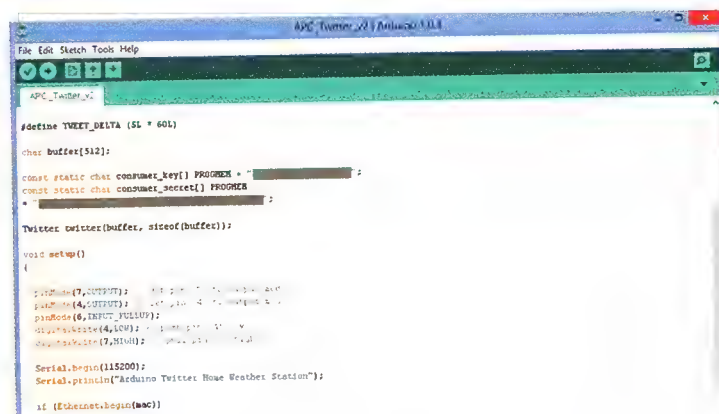
04 Click the 'Details' tab at the top, scroll down and click the 'Create my access token' button at the bottom. When the page updates, click on the 'OAuth tool' tab and on the new page, you'll see the 'Consumer Key/Consumer Secret' pair plus the 'Access Token/Access Token Secret' pair. Copy these and store them away in a notepad file somewhere safe.



The 'Serial Monitor' can monitor your own debug code to see if your sketch works as expected.

USING ARDUINO'S SERIAL MONITOR

You can monitor what your Arduino is doing by looking at the 'Serial Monitor' (the magnifying glass icon in the top-right). Plug your Arduino into your computer, load up with the sketch and launch the 'Serial Monitor' in the IDE. Make sure the speed (baud) rate on the bottom-right of the window is set to **115200** and you'll be able to monitor whether the Arduino is working correctly. We've coded it to tell you if there's a problem with the sensor or tweets not getting through. The 'Serial Monitor' is activated in the sketch by the `Serial.begin(115200);` line and data is written to the serial bus via the `Serial.println` commands.



05 Open up the Arduino sketch and copy the key/token pairs into the appropriate positions. You'll only need to do this once, provided you don't change the Twitter account for your Arduino. After that, your Arduino will be able to send tweets at will (well, within Twitter rate rules anyway). **END**

ROM CUSTOMISATION PART 2

Making your own ROMs

Darren Yates continues his series on how to customise your own Android ROMs using the Android Kitchen app.

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including *PC User's* UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

You'll find the bundled apps in the `/system/app/` subfolder.

Android has quickly become the operating system of the ages and is loaded into everything from cheap \$50 tablets to the latest eight-core smartphones. But with the right tools, you can customise official firmware releases (ROMs) meant for some of the latest phones, changing how the ROM works, adding in new apps and removing the unwanted bloatware. In the first part of this series, we looked at how to set up a virtual machine on Windows using VMware Player 5.0.2, installing Xubuntu 13.04 Linux and the Android Kitchen app. If you're a late arrival, you can grab VMware Player 5.0.2 from tinyurl.com/2xibcu, the 32-bit release of the Xubuntu 13.04 Linux distro ISO image from xubuntu.org/getxubuntu and Android Kitchen at tinyurl.com/93rw8h5. You'll also need the latest Java runtime engine but you can install that when you have your Linux virtual machine up and running from the 'Ubuntu Software Center'.

We won't go over the whole thing again, but the idea is that even though the Android Kitchen app we use requires Linux, you can do all of this on a Windows computer by

WARNING!

Creating your own customised ROM isn't difficult to do with Android Kitchen, but if you muck it up, it can brick your phone in extreme cases. We have tried this method with no problem on our Galaxy S III smartphone; however, we're providing this information for educational purposes only. It comes with no warranty or support if you try this and brick your phone. Note, too, that flashing your phone with a custom ROM will certainly void your phone's warranty, so do this at your own risk.

creating and working inside a Linux virtual machine. Finally, be aware that Android Kitchen doesn't support ROMs for every Android device – you can find the compatibility list and the app's home thread over at tinyurl.com/lwjlrar.

RUNNING THE KITCHEN

The very last thing we did last month was look at how to grab a ROM file for a Galaxy S II smartphone and how to get the Android Kitchen to disassemble it into a working folder.

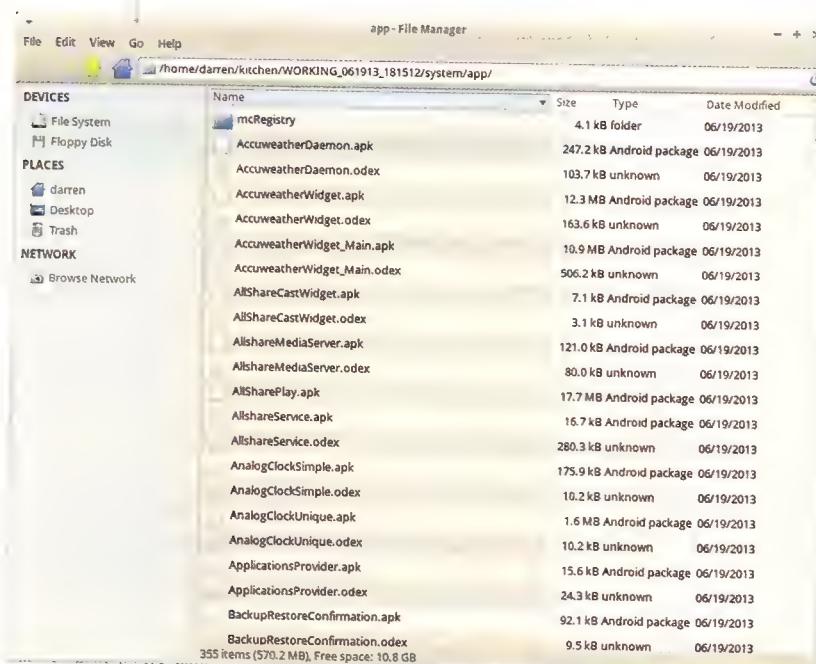
You might remember that Android Kitchen is a Python-language/Java-powered script that allows you to take an existing ROM, pull it apart, make changes and stitch it back together again so you can load it into your compatible phone or tablet. This month, we're going to switch over to Samsung's Galaxy S III. Samsung's ROMs for the Galaxy S III certainly aren't small – they measure up at around 1.2GB, so it's no wonder there isn't quite as much internal storage available as you might have thought.

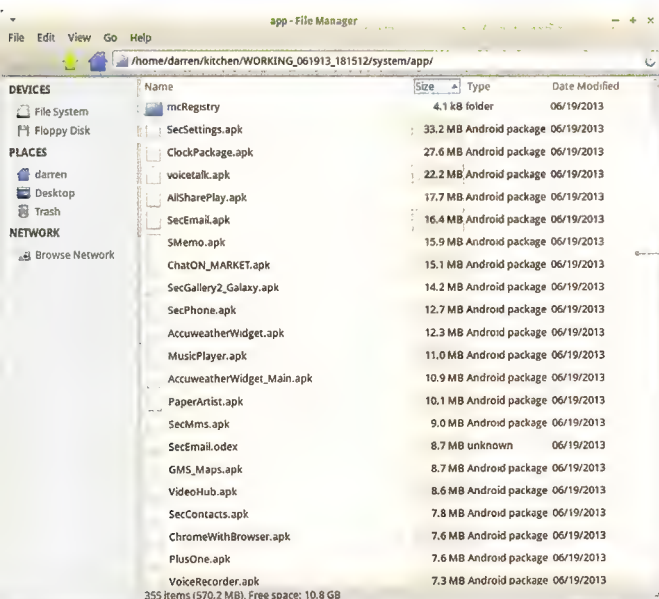
GETTING THE RIGHT ROM FILE

In some ways, the most complicated part of the process of creating a custom ROM is actually finding the right ROM file – not just the right ROM for your particular Android device, but the right archive file in that ROM download. For Android Kitchen to work, what we need is the basic ROM TAR file. TAR is roughly the Linux equivalent of an ISO image in Windows – it's a single file archive containing lots of files inside it, but it retains the file system of those files. However, sometimes you'll find ROM TAR files stored as 'TAR.MD5' files, which Android Kitchen can't recognise. The solution is nice and simple – just drop the '.MD5' bit with a simple rename in the Thunar file explorer so that you end up with a TAR file again and you should be fine. That file needs to be copied to your `/home/<username>/kitchen/original_update/` subfolder. Remember that Android Kitchen can't work if your username has spaces in it. You must move the kitchen file path to `/home/` instead.

SETTING UP THE WORKING FOLDER

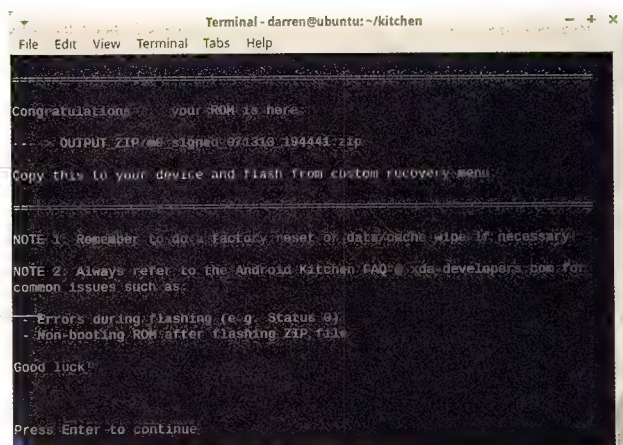
With the ROM TAR file in the right location, you can launch Android Kitchen (open a Terminal inside the `/kitchen` folder and run `./menu`) and select option '1' to create the working folder from your ROM. Follow the basic prompts (you'll need your username's password) and when you're done, you'll get an info panel on what extra features are inside your ROM.





Set your file manager to show the largest files first and select from these to maximise space.

This shows the final build message from Android Kitchen when your new ROM is done.



ADDING ROOT ACCESS

Now that you're set up, the first thing you'll want to do if you're customising your own ROM is to give it root access. Root access allows apps to access the root folder of the Android operating system to perform extra features not normally allowed by Android. For example, you need it if you want to run Samba Filesharing, or if you want to connect your PlayStation 3 DualShock gamepad to your phone via Bluetooth. You may just want it because you don't like being locked out of your own phone.

There is a security downside in that if you can get to the root folder of your phone, so can any rogue app that may try to steal credit card details, your contact list, you name it. Is it a problem? If you know what you're doing and you're not in the habit of loading in every app under the sun, no, it shouldn't be a problem. However, it's one of the 'use at your own risk' features of most custom ROMs like CyanogenMod.

SUPERSU OR SUPERUSER?

When you're ready to add root access to your ROM, press '2' on the main menu. As soon as you do, you have to decide which superuser app you want installed. Superuser is essentially an app that allows you to control how other apps interact with your root access. The most common option you see in custom ROMs is the app named Superuser, although this free version is fairly limited. The alternative is called SuperSU and is more for Android fanatics, with more options and some nice extras including claimed faster notification speed.

If you're just after the ability to run apps that need root access, Superuser is fine and all you'll need. If you're a more serious user, give SuperSU a go. To make your choice in Android Kitchen, press C for SuperSU or D for Superuser.

BUSYBOX

Another option you can add to your ROM is BusyBox. It's a tool that combines hundreds of Linux command line tools into one app, such as the commands mkdir (make directory), mv (move), gzip (file compression) and loads more. Do you need it? If you've never used the command line before, then probably not, but it's as close as you'll get to turning your Android ROM into a more Linux-ified operating system. BusyBox doesn't turn your Android ROM into a generic Linux distro, it just gives you access to those Linux command line apps.

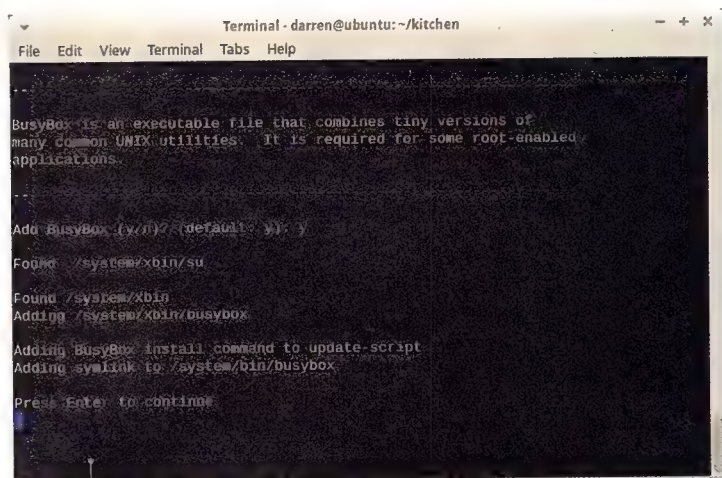
If you don't root your ROM, there's little reason to install BusyBox because the program needs root access. However, if you do root your ROM, installing BusyBox is a good idea as some root access apps need access to BusyBox commands. Also, you'll likely need to install a Terminal emulator to run BusyBox commands. You can grab Android Terminal Emulator from Google Play (tinyurl.com/bwf8me4).

ADDING & REMOVING APPS

For me, the fun bit of making/baking your own ROM is choosing to add -



We're using the latest available ROM for Samsung's Galaxy S III this month.



Installing BusyBox if you root your ROM is a good idea.

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or remove – apps and truly making it your own. In the case of Samsung's most recent Galaxy S III ROM at the time of writing, it could be that you simply want to reduce its huge 1.2GB size into something a little more manageable by removing some of the apps you neither want nor need.

When you create an Android app using the Android SDK and the Eclipse IDE, you end up with a single APK archive – essentially a ZIP file – which you can then install onto any appropriate Android device. Apps baked into a ROM are just packed in as their original APK files, which greatly simplifies both adding and removing apps.

When Android Kitchen pulls apart your initial ROM file, it puts everything in a subfolder of the `/home/<username>/kitchen/` path called 'working' following the date and time; for example, `/WORKING_061913_181512/`. Bundled apps are stored in the `/system/app/` subfolder; however, inside that folder you'll probably find not only APK (Android Package) files, but also ODEX files, too.

ODEX OR DEODEX?

Now is a pretty good time to introduce the idea of the ODEX file and the concept in custom ROMs of odexed and deodexed apps. When you create an Android app using the standard Android SDK/Eclipse compile method, you end up with a single APK archive file; inside that file is a 'classes.dex' (Dalvik Executable) file. It's essentially the compiled part of your Android app. We could spend days talking about the heart of Android – it's a Dalvik virtual machine – but keeping perspective, all you need to know for now is that the DEX file is run by the Dalvik virtual machine, so it's a key part of your app.

That all exists inside the APK archive. The ODEX file is an optimised Dalvik executable. It's compressed and contains parts of the app that Android can load when it boots up so as to speed up app loading times. Remember how it's often been said you shouldn't empty Android memory? This is one of the reasons why – the memory is loaded up with these ODEX files. However, there are issues with odexed apps. First up, your app now exists as two separate parts: the ODEX compressed file and the APK archive. While it's easy to rip inside an APK archive, ODEX files are much harder to get into. Also, ODEX files get moved to another location when your ROM is installed, so you'll then have two locations of app files to sort through to fully remove an app if you tried to do it post-ROM install.

A deodexed app is one where the ODEX file has been decompressed and its components put back into the APK file as a standard 'classes.dex' file. If you write your own Android apps using the standard Android SDK/Eclipse IDE method, no separate ODEX file is created so essentially, your apps are already deodexed.

The bottom line is odexed apps supposedly load faster; deodexed apps are easier to manipulate.

ZIPALIGNING ALL APPS

There's one other trick that can make up for that faster loading time difference between odexed and deodexed apps and that's called zipalign. Google recommends that every app developer runs their final key-signed app through the zipalign command line tool before uploading it to Google Play. It's a way of ordering the contents of the APK file so that all uncompressed raw data (images or whatever) are aligned on four-byte boundaries. In short, it reduces the amount of RAM an app chews up when it's running.

So in the end, it's suggested that deodexed zipaligned apps run just as fast as odexed apps, but with lots of advantages: you get an app that's a single APK file, it's stored in one location, it's easier to manipulate and it uses less RAM. For these reasons, you'll find most custom ROMs are both zipaligned and deodexed for your Android computing pleasure.

REMOVING APPS

If you're wondering what all that has to do with customising ROMs, go back and re-read it. At the very least in our context, it means that to remove an app, if you see an APK file accompanied by an .ODEX file of the same name in the `/system/app/` folder, you need to remove both.

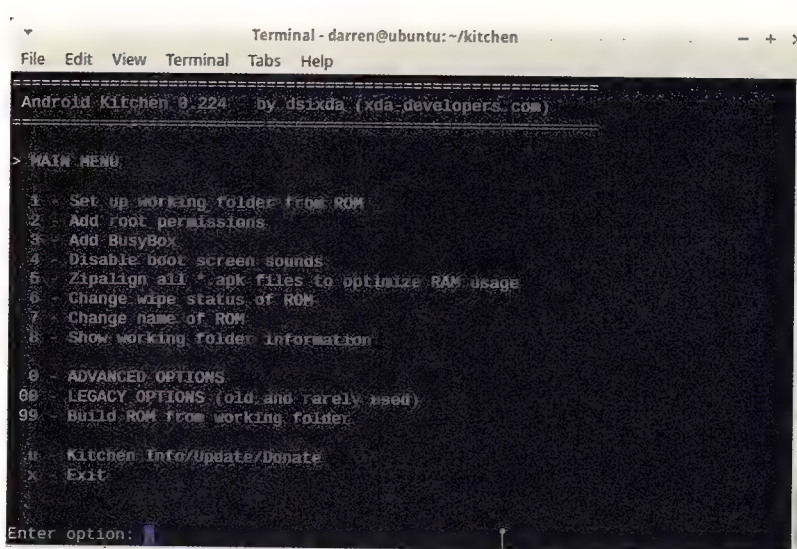
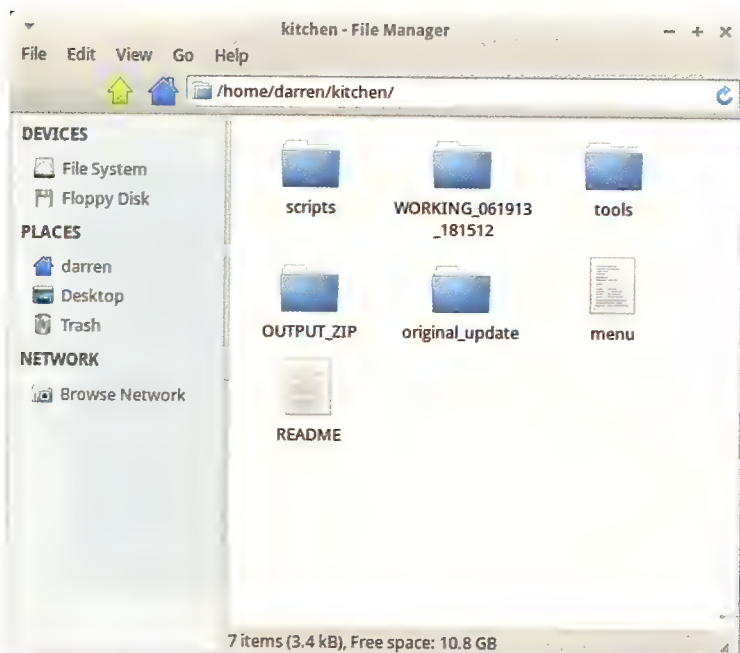
The next big question is: which apps do you remove? If the ROM has been built well, the apps should still have their clear-language names, so you'll get some idea as to what they do. The best way, though, is to go through your ROM's `/system/app/` folder, look at each app, research what it is, what it does and where it comes from. Based on that, you can decide whether it stays or goes. If that sounds too complicated, well, with over 800,000 different app possibilities you could find in your ROM, that's the only sane way to do it. As it is, our test Galaxy S III has some 355 files and 570MB of apps in that folder to go through.

Here's a quick tip: set your Thunar view of that folder to show the largest files first. That way, you research the largest files first that can gain you maximum space by removing them. Notice we've been saying 'remove' not 'delete' – ideally, you should just move these unwanted files to a folder outside of the Kitchen's working folder for safekeeping. Why? Rather than starting the Android Kitchen process from scratch, it's always easier to just add in any apps you've removed.

If you have a Samsung Galaxy device, there's a list over at the xda-developers.com web site that gives you a pretty reasonable starting point for apps you can remove. By the looks of it, it's quite aggressive in its suggestions and we can't guarantee it won't stuff up your ROM build, but if you need a starting point, head to tinyurl.com/morrzce.

ANDROID KITCHEN OPTIONS

Note that Android Kitchen doesn't need to know anything about apps you add or remove – you do all of this in the file manager of your Linux distro



The Kitchen stores your expanded ROM in the working folder subfolder.

You start the rooting process by selecting option '2'.


```
Terminal - darren@ubuntu: ~/kitchen
File Edit View Terminal Tabs Help

BOOTING

The following will be done for root:
Add Superuser app and su binary
Add necessary lines to the update-script
Update default.prop in the ramdisk

Which version of the Superuser package do you want to install?
c - Chainfire's SuperSU
d - ChainsDD's version
v - Original version (very old)
x - Cancel rooting (default)
```

Choose between Chainfire's SuperSU or ChainsDD's Superuser apps.

(Thunar if you're using Xubuntu like me).

When you're done with that and go back to the Android Kitchen menu, you'll see option '5', which is to zipalign all APK files to optimise RAM usage. Hopefully after our discussion, it now makes sense what this does and why you'd want to do it. The following option ('change wipe status of ROM') determines what the ROM will do to your onboard data when it's flashed onto your phone. The default option is 'do nothing', meaning it won't touch your existing data and will be like doing a Windows upgrade rather than a fresh install. The alternative is that installing the ROM also wipes your data from the phone.

As we said, the default is to do nothing, but if you decide you want data removed as well, you need to tell users that's what your ROM does if you decide to distribute it. In reality, we don't think there's a need to wipe data upon ROM installation, as it's easy enough to reset a phone within the Android OS itself if it's later required.

```
Terminal - darren@ubuntu: ~/kitchen
File Edit View Terminal Tabs Help

Working folder information (v0.224)

Android OS version: 4.1.2
Device: m0
Model: GT-I9300T
ROM Name: JZ054K.I9300TDUELL2
CSC version: I9300TVAUELL2
Rooted (Superuser app + su): YES
Rooted (unsecured boot.img): YES
BusyBox installed: NO
BusyBox run-parts support: NO
Apps2SD (Apps to EXT) enabled: NO
/data/app enabled: NO
Custom boot animation allowed: NO
Nano text editor installed: NO
Bash shell support: NO
/system/framework is deodexed: NO
/system/app is deodexed: NO
modem.bin found: YES
ROM will wipe all data: NO

Press Enter to continue
```

And finally, check the info panel to ensure the ROM is now rooted.

Zipaligning your ROM is something you should do to minimise RAM usage.

```
Terminal - darren@ubuntu: ~/kitchen
File Edit View Terminal Tabs Help

Creating ramdisk cpio archive

Attempting to determine kernel base address
Using base address of 0x10000000
Using ramdisk load address of 0x11000000
Attempting to determine command line parameter
No cmdline

Building new boot.img ...

newBoot.img created
Moving to working folder as boot.img

boot.img size
Old: 5.1M
New: 5.1M

Removing BOOT-EXTRACTED folder

Finished rooting

Press Enter to continue
```

After that, the root process will be performed on the ROM.

REBUILDING THE ROM

Finally, the last step we'll look at this month is simply rebuilding your ROM. To do that, you just select option '99' from the Android Kitchen menu. The great thing is that the Kitchen maintains your working folder even after the ROM build is complete, so you don't have to disassemble the ROM every time you want to come back to it to modify it.

Building your ROM will take some time, of course, but it'll appear in the 'OUTPUT_ZIP' subfolder as a ZIP file ready to install onto your phone using your phone's 'Recovery' menu (and ideal option is something like 'ClockworkMod Recovery'). We'll look at this and other ROM customisation options next time.

Just remember that flashing your Android device with a customised ROM will void its warranty. We won't be answering emails or requests for help, so if you do make and flash your own ROM, you do so at your own risk. **END**

```
Terminal - darren@ubuntu: ~/kitchen
File Edit View Terminal Tabs Help

Zipalign is a procedure that will optimize all of the *.apk
files under your working folder for better RAM utilization.

NOTE: The option to zipalign all *.apk files will also be
provided when you build your ROM, so it is not necessary to
zipalign now.

Proceed with zipalign (y/n)? (default: y):
```




RECEIVER

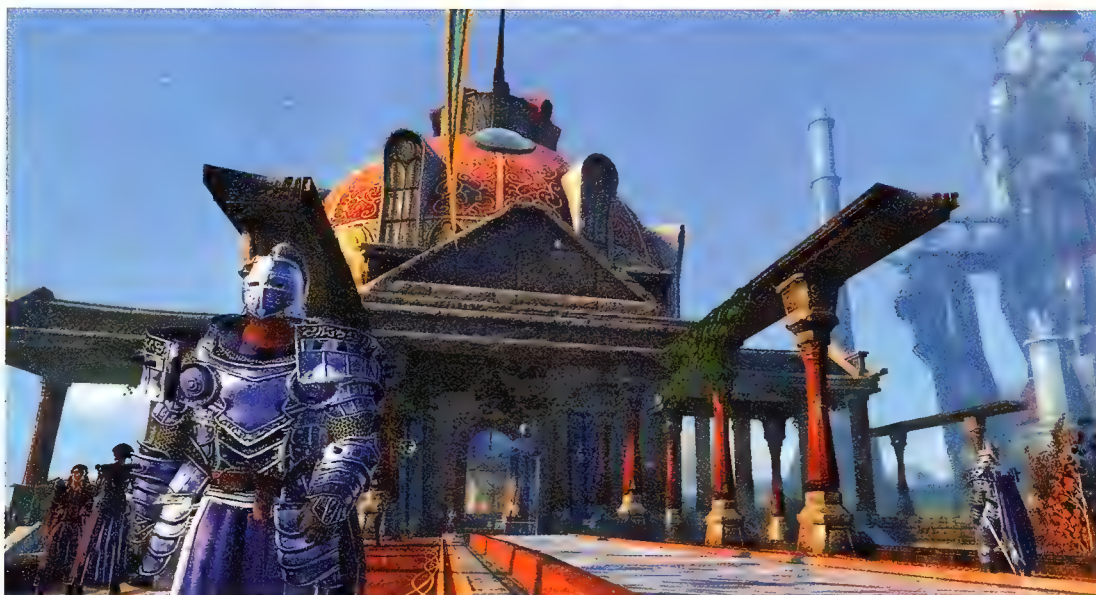
An exercise in gunplay.

@ www.wolfire.com/receiver
\$ US\$4.99

PC

Players are dropped into a randomly-generated world filled with automated turrets and drones, and asked to scavenge for ammo while looking for 11 audio tapes. Developed as part of the seven-day FPS challenge, *Receiver* rethinks gun mechanics in gaming. We're used to running around in shooters using one button to fire and one to reload; it's a mechanic that ignores the genuine complexity of weapon handling to keep it simple so we can instead concentrate on targets. *Receiver* turns that focus around by splitting operations into discreet controls: one button releases the mag, another loads a bullet, re-enters the mag, another to draw the slide... you get the idea. Expect to get it wrong, a lot. The amount of times I dropped a bullet instead of loading it is staggering. It's a complex keyboard dance and takes practise to become remotely proficient in, but when you get that perfect reload through muscle memory, it's a sweet feeling.

TC



Neverwinter

A free-to-play MMO you can build as well as play.

PC

@ www.perfectworld.com \$ Free to play with in-game purchases

Neverwinter is a free-to-play RPG that somehow nails that sense of second-by-second satisfaction of popping a roll of bubble wrap. Pop, a monster goes down. Pop, a sparkling light trail to get you straight to the next one. Pop, the chime of a new level earned. *Neverwinter* is a game of cold proficiency, built with experience and understanding of these moments and how to create them.

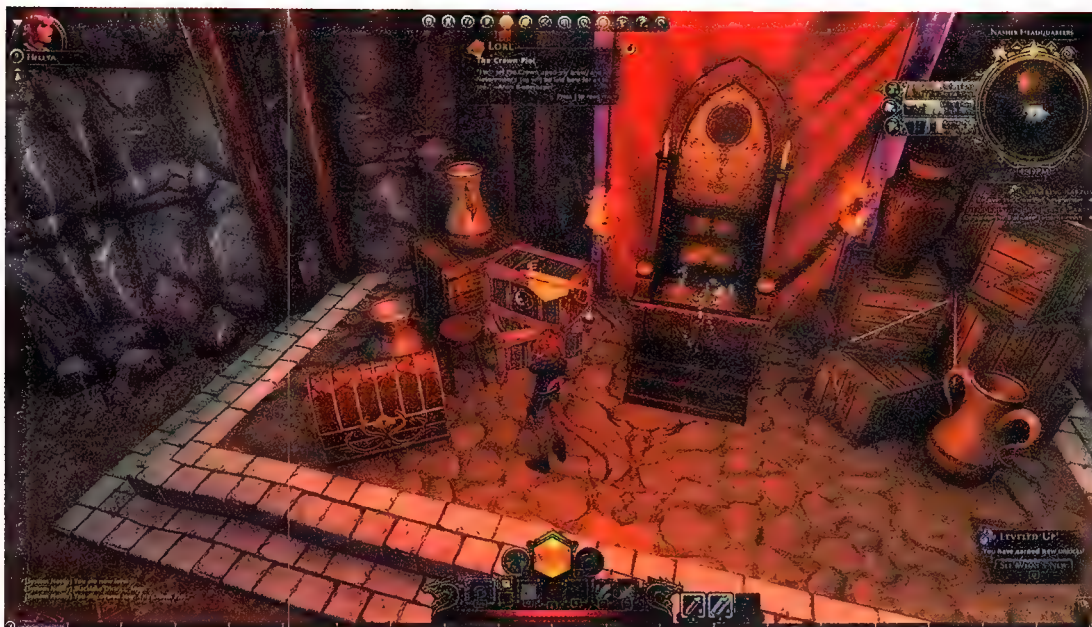
Too bad it's also one of the least creative games ever to waste the opportunity to do something interesting with them. Whereas *Dungeons & Dragons* at least attempted to offer a more in-depth dungeoneering experience, *Neverwinter* follows the standard genre template to the letter. It's a game where I swapped armour pieces a thousand times only to look exactly the same, and one that has nearly as many currencies as it has character classes: three and five, respectively. Sadly, never have the Forgotten Realms been quite so forgettable. The main questline could be largely replaced by a box that says: 'Watch Netflix for 30 hours, then click here for a free hat'. The characters are personality vacuums with little to note but their awful accents. Competitors like *Pandaria* and *Guild Wars 2* have advanced MMO questing to the point that even bits of *Neverwinter* which actually try to offer some spark, can barely gaze upon them without being instantly struck blind. At times, it seems wilfully unimaginative; most notably, with the constant repetition of the same basic boss template: a tank that spawns minions to mildly inconvenience adventurers who just want their damn quest rewards.

What really stands out is how much better the community is at content creation than the designers. Like *City of Heroes* and *Star Trek Online* before it,

Neverwinter offers player-created missions through the 'Foundry'. These missions are scattered around the world and offer rewards just like regular quests, and while their creators don't have remotely the same access to scripting and world design as *Neverwinter*'s actual designers, the best of these player-built missions utterly humiliate the official stuff. Two in particular stand out: 'Bored of Being the Hero', in which you get help from a mysterious source to turn to the dark side, with a mystical item of your choice and potential backup of an army of shades; and 'Whispers from the Void', which stretches the tools to the max to create a spooky, well-framed little Lovecraftian tale.

These examples excel despite the frustrating limitations of the editing tools used to create them. Granted, these tools are staggeringly freeform and integrated into the game by MMO standards, but there's a sense that *Neverwinter* doesn't quite trust its players enough to let them play with the whole toy box. Given that this is Cryptic's third attempt at enabling players to get involved and *Neverwinter*'s lineage as the RPG on which you could host your own games, it's hard not to notice the restrictions placed on what ordinary players can create compared to the official stuff. *Neverwinter Nights* this is not, though it would like to be, and will hopefully get closer over time.

Neverwinter takes about 20 levels before starting to cough and hold out a bowl. Along with regular gold, there are two main currencies: Astral Diamonds and Zen. Astral Diamonds can be earned to some degree in-game by such acts as running dailies and being tipped by other players for making interesting



FAR CRY 3: BLOOD DRAGON

More mod than game.

@ fc3blooddragon.uk.ubi.com
\$ \$20

PC • PS3 • 360

More mod than anything broader, *Blood Dragon (BD)* is a heavily stripped-back and streamlined standalone expansion to the excellent *Far Cry 3 (FC3)*. Inspired by nearly every game I played in the arcade during the '80s, players take on the role of Sergeant Rex Power Colt, a Mark IV Cyber Commando on a mission to get the girl, kill bad guys and save the world. It's a super-cheese-fest homage to retro gaming and action films, which as a man-child who grew up then, sounds like the best game ever made. Perhaps it's just a case of *BD* releasing too close to its source, as sadly it just didn't strike a chord. Instead, roaming around similar landscapes in the near-dark, liberating garrisons and cherry-picking from limited missions felt instead like a really crap edition of *FC3* with my screen brightness down low.

TC

missions in-game. They can also be traded for Zen. Astral Diamonds are the 'service' currency used by NPCs. Zen is the cash shop one, used to buy things like the now inevitable lockbox keys, advanced companions and fancy mounts. Both are kept out of the way for a while, but there's almost an audible click when *Neverwinter* starts doing things like giving out a token for five hours mount rental and putting a cash shop vendor next to the gold-based shop that sells the expensive beasts. Or when it takes your Companion half an hour to go away and level up without a few thousand AD to grease the wheels. This is also the time when a smart adventurer will realise how reliant they are on *Neverwinter's* generosity with Identify scrolls, and that the Coalescent Ward consumable that guarantees late-game gear upgrades work is suspiciously expensive. Still, the only things you need can be bought with gold and/or AD, and plenty of both is available in-game if you're willing to sit around for a while now and then and earn it.

By this point, however, I'd popped enough bandit-shaped bubble wrap that the thought of tearing the shrinkwrap off yet another roll had lost all appeal – free or not. In that time, over 10 hours, exactly one official quest had offered a genuinely interesting experience. The mission was to investigate a mysterious figure abusing the city's trust in order to

use sufferers of something called the Spellplague to build himself a path to godhood. Godhood inevitably translating as 'turning into a disappointingly crap boss who spawns minions'. After that brief and mildly intriguing interlude, normal boring service immediately resumed. Ordinarily, this emptiness would be a killer.

Mechanically, *Neverwinter* is solid, but its content is painfully behind the times and far too dull to stand up against the competition, especially when that competition includes (shudder) buy-to-play games rather than simply other free ones. Factor in the opportunity for player-created content to fill that gap, however, and for improved design features to enable that player creativity, and it seems likely things will feel much fresher in a few months' time. Being this reliant on players to compensate for its crushing lack of creativity isn't exactly a point in *Neverwinter's* favour. Giving them the power to do so, though, definitely is. And that's something other MMOs would do well to copy.

Richard Cobbett

- ✓ Limited yet powerful user creation tools.
- ✗ Plays like yesterday's MMO by the merits of its own content.

6
10



8
10

ANIMAL CROSSING: NEW LEAF

There's a new mayor in town.

@ www.animal-crossing.com/newleaf

\$ \$58

3DS

Surely it's a coincidence that I can trace the source of my anxiety and fascination with Furries to the release of the first *Animal Crossing* on DS. As cute as it is, it's stressful maintaining relationships with the animal Joneses, keeping a tidy house and making enough Bells to repay the shifty Raccoon Dog, Tom Nook. This time around I don't feel nearly as twitchy, even though as mayor of my new little town (I named mine Hodor) there's more responsibility than ever. As well as still being able to fish, fossick, bug hunt, write letters to each other and dress up, players can now also take a broader role in their town's development. There are public works projects (building bridges, seats, camp grounds and so on) to fund and build, as well as town ordinances (which provide small bonuses or shifts town operating parameters) to set. It does feel like a simple side-step to gaming we did years ago and feels more like all that's achieved is 3DS compatibility, but it's still a ton of furry fun.

TC



The Last of Us

Carefully orchestrated storytelling.

PS3

@ thelastofus.com

\$ \$98

There are times while playing through *The Last of Us* (TLU) where you'll wish you could reach into the PS3 and give everyone over at Naughty Dog a digital high five. That's sadly a limitation of the hardware, but one the developers are probably thankful for, as there are just as many moments where you want to slap them. On one hand, it's a genuine triumph of storytelling, providing an experience that's emotional and instantly ingratiates itself into your heart. On the other, it's a game undermined by clusters of repetitive gameplay and hamstrung by inconsistent AI and combat.

Before I really get started, I'll preface this by saying with fair certainty that we've seen enough apocalyptic infected – zed – survival games lately to be tired of the premise. However, *TLU* plays it a little differently. While there's definite inspiration from the likes of *The Road* and *The Walking Dead*, it shows us a world where the fungal-based parasite Cordyceps attacks the human race on a global scale, transforming people into deformed spore-monsters and all but wiping us out. Look it up, it's terrifying.

The game opens at the start of the outbreak when the confusion and chaos first begin. We're introduced to our protagonist Joel as he struggles (and ultimately fails) to keep his family safe. Fast-forward 20 obviously tough years later and the world's population survives mostly in small, policed quarantine zones while bandits, infected and rebels steal, beg, infect and kill on the outskirts. Joel has etched out a niche as a smuggler and is known as the go-to guy for anything off the radar, routinely heading outside the walls to source and deliver medicines, ammo and weapons to whoever's buying. But an unexpected turn of events sees him take the job – and the primary push of the game – of escorting a special young girl called Ellie to the resistance group The Fireflies.

What transpires is essentially one giant, 15-hour escort quest split across the seasons of a year. It's a clever setup in that it allows Naughty Dog to take a

bunch of ideas and clamp them together cohesively enough to be believable. All this while overlaying it with the genuinely emotional storytelling and characterisation we've come to expect from the same stable as the *Uncharted* series. The banter and incidental dialogue between characters is wonderful and the fatherly relationship that builds between Joel and the naive young Ellie will have you accusing the dust in the air for the tears in your eyes before the credits start to roll.

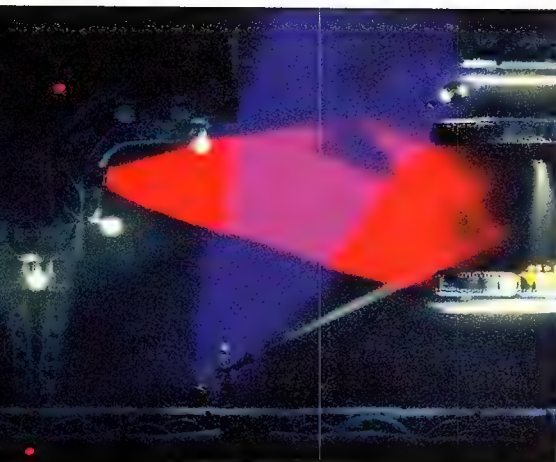
Sadly, the third-person gameplay doesn't carry the same weight of excellence and trends in part to territory better labelled contrived. Feeling like it's pasted from *Uncharted*, you move the analogue stick in the general direction of forward through linear terrain, while enjoying some limited platforming and exploration as you forage for ammo and crafting materials. In between those forward-exploration moments are the forward-combat moments, which are telegraphed by rooms strewn with conveniently placed cover points for line-of-sight sneaking. Thankfully, the excellent enemy AI saves the day. The infected are simply terrifying – especially Clickers, which use echo-location to zero in and eat you – while human enemies constantly work together and communicate to flank and bum-rush Joel and Ellie. Armed with limited ammo and a conservative range of weaponry, combat is a mix of ranged fighting, evasion and really brutal, bloody melee with whatever's on hand. There's an on-the-fly crafting system as well, which uses scavenged parts to jury-rig spork bombs, smoke grenades and shivs to bolster Joel's arsenal and usher players through to the next checkpoint.

There's not a lot of replay value here as the magic and spontaneity is lost when scripted dialogue threads and checks unravel. As great a story as it is, I hope this is the last we see of Joel and Ellie. I'm more than satisfied to say goodbye to them. Despite its often unprogressive gaming, as a complete package it's a wonderfully genuine story set in a masterfully crafted, gorgeous and believable world. Surely there are more stories out there to tell.

Troy Coleman

- ✓ Fantastic storytelling, some excellent dynamic AI, brutal hand-to-hand combat.
- ✗ Boring repetitive ranged encounters, mixed friendly AI.

8
10



The Swapper

Exchanging big guns for clones and clever puzzling.

PC

@ facepalmgames.com/the-swapper \$ US\$14.99

Built of clay and the echoes of Stanley Kubrick's creative ghost, side-scrolling puzzler *The Swapper* is superb. It's clever, moody and forward-thinking in its disdain for conventional, perma-roided protagonists. But also frustrating. Like the charming rapsallion you can't help but like, *The Swapper* will drive you up the wall and have you coming back for more.

Disquieting in the lonely way that only abandoned spacecraft can be, the game hinges on a single conceit: you can make clones. With the help of the titular device, you can generate a replica of yourself with a click of the right mouse button and then propel your consciousness into that new body with a tap of the left. It's that simple. And that gruesome. They're the mainstay of your interactions with the game – you'll use them to push blocks, stand on buttons and do whatever is necessary to unearth the mystery of your surroundings. In the process, however, you're going to kill them. Repeatedly. At times, it'll be accidental. At times, you'll fling them knowingly off a ledge to get what you want. But there's nothing wrong with that, right? They're just empty vessels, containers your mind has oh-so-recently vacated.

When it's not otherwise asking you to evaluate the measure of a soul, *The Swapper* will have you manoeuvring through the Thebeus's labyrinthine depths in an attempt to gather a congregation of orbs by circumnavigating levers, obstacles and coloured lights. It's a routine concept, but one implemented with a delicious amount of competence. While they progress at an expected incline, they can still be absolutely rage-inducing, as there's no way you can get around solving one of these buggers.

The Swapper is one of those games that will stick in your mind. Years down the road, when you have grandkids demanding tales of retro-tastic delights, it will be among those you reminisce about when you're looking for examples of nonviolence done right.

Cassandra Khaw

✓ Low-key, effective storytelling and a hyperfocus on puzzles.

✗ May cause existential loneliness.

8
10



New Super Luigi U

Mario in hard mode.

WII U

@ www.nintendo.com.au \$ \$59.95 or \$29.95 download

The 2D *Mario* experience is one that Nintendo's plumbed endlessly, but *New Super Luigi U* at least tries something a little different: making it hard. This is *New Super Mario Bros U* with the difficulty solidly notched up. You play only as Luigi in single-player and he's a slippery little sod with different jump mechanics to Mario. He's got shorter levels to run through, but only 100 seconds in which to do so, rather than the 300 of a 'normal' *Mario* game. It's essentially DLC for *New Super Mario Bros U* that you can either buy as a standalone disc or as a cheaper digital download, as long as you own *New Super Mario Bros U* itself.

This gives the game something of a *Super Meat Boy*-style aesthetic, as it's properly hard and not at all afraid to be so. It's also not afraid to ask you over and over again if you'd like to post to Miiverse every time you finish or fail, which quickly becomes annoying.

New Super Luigi U can provide a stiff yet fun challenge in most levels, although there are areas where you'll most likely die simply because there's little warning of a trap, and absolutely no time to stop and consider your next jump. Unlike *New Super Mario Bros U*, where multiplayer was often harder because you'd bump off each other, multiplayer is actually a little easier, if only because one of you can die and the other will continue onwards. There's plenty of secret content to discover, presuming you make it through the game, but like its predecessor, it's not exactly original stuff and basically exists for the hardcore fans only. Nintendo still knows how to make a great 2D platformer, but this is quite a niche game.

Alex Kidman

✓ Solid challenge in familiar setting, great for pickup and play.

✗ It's just more *Mario* DLC, some deaths are cheap.

9
10



CANDY CRUSH SAGA

Sweet and juicy has never tasted so aggressive.

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IOS • ANDROID

It may be just another block-clearing game, but it's best not to hide the fact that you play it. Gather your family and friends together in a kind of reverse intervention and be honest. "I play *Candy Crush*," you'll say. Chances are amid the gasps and mock horror, there'll also be others like you. There'll be a shuffle as devices are whipped out while everyone gets their *Crush* on – you're safe among friends. It's set up like any other blocker: players slide coloured blocks around the screen to form and clear rows of three or more in progressively more difficult levels, all while dodging the app's incredibly aggressive attempts to get you to connect with Facebook or buy power-ups. You generally have the goal of clearing certain blocks each level and only a limited number of turns to do it in, otherwise you lose a life. You only get five lives, but they perpetually regenerate after 20 minutes of real time. Block on, comrades!

TC



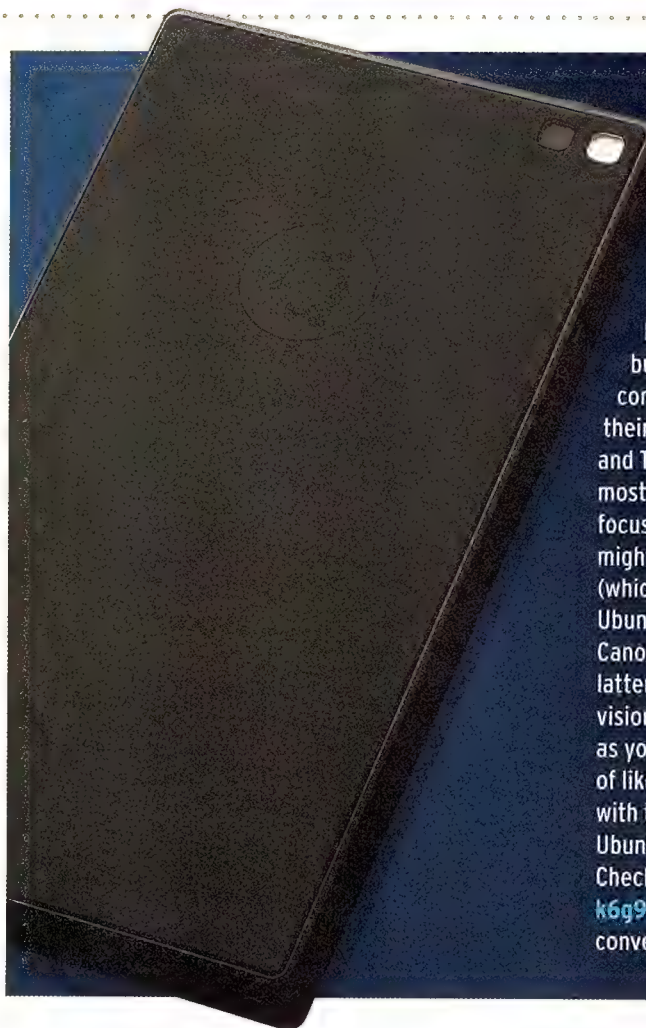
FOOD WITH INTEGRITY?

Once upon a time, you could get a marketing edge on your competitors by simply investing a little time in creating a social media presence. You know: a Facebook page, Twitter account, occasional competitions, that sort of thing. But now that every Tom, Dick and Harry already has that set in place, what's the next step? Chipotle, the ginormous chain of US-based Mexican grill restaurants, decided that having its Twitter account hacked was the best way to get people talking about their brand. So they faked their own Twitter hack, tweeting a range of cryptic messages that made it look like someone had seized control of their account. The result? New Twitter followers poured in at 16 times the normal rate and retweets also saw a massive bounce. Seems people love a good hack, even if it's entirely staged.



TWEETER THAN THE TRUTH

Chipotle (see above) isn't the only scurrilous corporation seeking to mislead you via Twitter, either. That curious honour is also bestowed upon... um, Twitter. The social networking giant was caught out recently using real people's Twitter accounts, including their profile pictures, alongside tweets they never actually sent. As part of a campaign to promote the company's advertising smarts (somewhat ironically), Twitter incorporated real users into a mock-up graphic, supposedly tweeting things like: "I wish I could make fancy lattes like in the @barristabar commercial" and so forth. The company later apologised. By tweet. So how can we be sure it was actually from them?



PACKED LIKE SARDINES

How many smartphone platforms are really necessary, would you say? We've already got iOS, Android, Windows Phone and BlackBerry occupying centre stage, but there's a gazillion other mobile contenders vying for a good snap at their heels, including the likes of MeeGo and Tizen. But in terms of wildcard entries, most of the attention at the moment is focused on two not-so-young-names-you-might-recognise upstarts: Firefox OS (which launched in Europe in July) and Ubuntu Edge. At the time of writing, Canonical is attempting to crowdfund the latter, which is the Linux heavyweight's vision of a smartphone that can double as your desktop PC when required, kind of like Motorola's Webtop experiment with the Atrix a couple of years back. Can Ubuntu succeed where Motorola failed? Check out the campaign (tinyurl.com/k6g93z8) if you want to help make the convergence dream a reality. **and**

j5create

ULTRA STATION (JUD500)

All the Ports You Need in One Sleek Design

The Ultra Station is an intelligent USB 3.0 laptop docking station that provides a host of connectivity options for Ultrabooks, laptops and MacBooks. In addition to allowing a second monitor to be attached via HDMI or VGA connectors, the Ultra Station has connections for Ethernet, speakers, microphone and other USB 2.0 and 3.0 peripherals. The Ultra Station also contains j5 create's Wormhole technology which allows you to copy and share files across two computers by simply dragging and dropping. Connecting two computers with just one USB cable, the Ultra Station is the perfect solution for expanding your Ultrabook or MacBook into a full size workstation. Increase productivity with cross-platform multitasking.



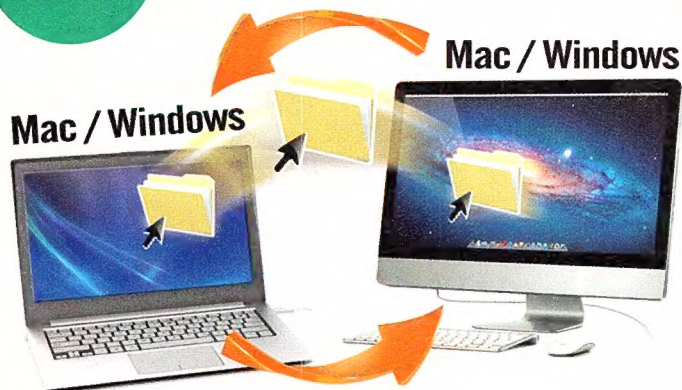
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WORMHOLE SWITCH (JUC400)

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The Wormhole Switch is a "must have" product for mobile computer users. The simple USB-to-USB cable design makes the Wormhole Switch easy to use and with its plug-and-play design there is no lengthy installation process. By connecting two computers, either Mac or Windows OS, the cable allows its users to drag and drop any size files from one computer to the other and share keyboard and mouse functionality. j5 create's Wormhole technology gives the connected computers the ability to cut/copy/paste, drag/drop, and share data, photos, videos, music or other files almost instantly. You are no longer limited by file size, transfer speed, or platform compatibility with j5 create's Wormhole technology.



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HOT
Gadgets

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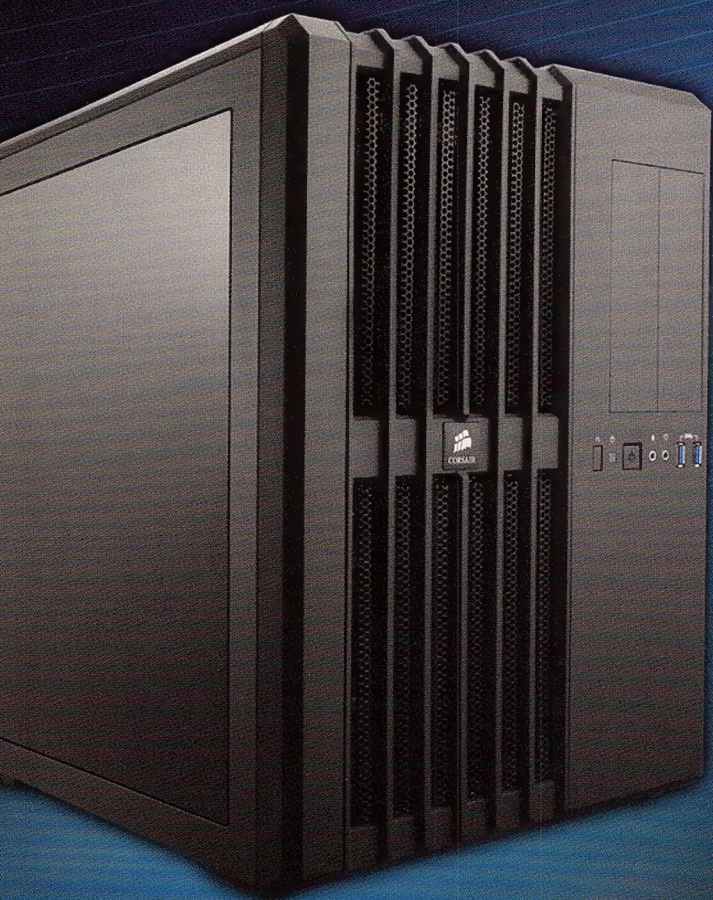
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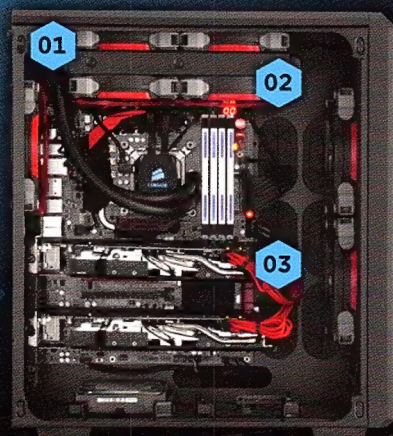
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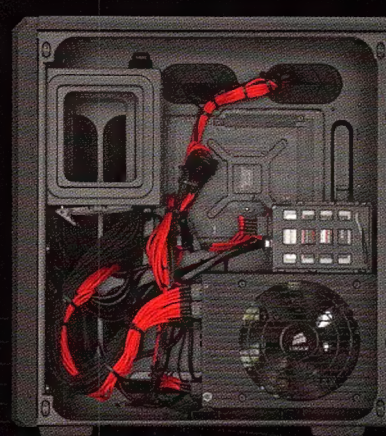
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